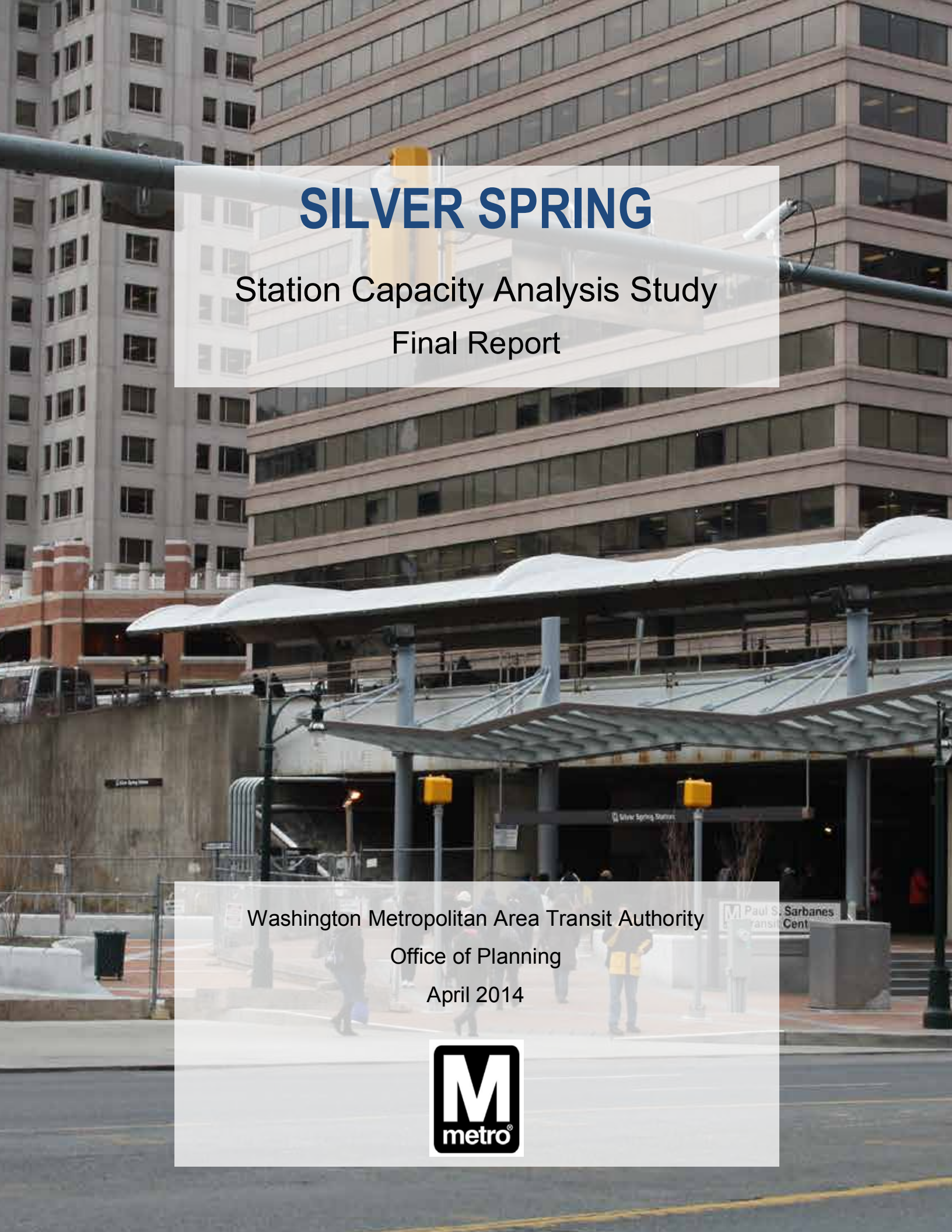


SILVER SPRING

Station Capacity Analysis Study

Final Report

Washington Metropolitan Area Transit Authority

Office of Planning

April 2014

Table of Contents

Executive Summary **1**

1.0 Introduction **5**
1.1 Background 5
1.2 Study Purpose 7
1.3 Report Organization 7
2.0 Existing Conditions **8**
2.1 Station Overview 8
2.2 Station Area and Planning Context 14
2.3 Existing Station Conditions 18
3.0 Future Travel Demand and Station Conditions **19**
3.1 Forecast Travel Demand 19
3.2 Changes in Station Access Related to New Transit and Pedestrian/Bicycle Facilities 21
3.3 Future No Build Condition Pedestrian Model Simulations 24
4.0 Station Improvement Concepts **38**
4.1 Design Considerations 38
4.2 North Mezzanine New Elevator 39
4.3 Purple Line-Metrorail Mezzanine Connection 40
5.0 Comparison and Evaluation of Design Alternatives **48**
5.1 Metrorail Station Passenger Volumes with New Station Entrance 48
5.2 Improvement Concept 2030 Pedestrian Model Simulations 51
5.3 Capital Cost Estimates 61
5.4 Summary Evaluation of Improvement Concepts 61
6.0 Conclusion **66**

List of Figures

Figure 1-1: Station Location 5
Figure 1-2: Station and Vicinity 6
Figure 2-1: Existing Metrorail Station and Adjacent Transportation Facilities 9
Figure 2-2: Silver Spring Metrorail Station General Layout with Adjacent Facilities 10
Figure 2-3: Metrorail Station Layouts of Platform and Mezzanine Levels 11
Figure 2-4: Station Mode Access Share, 2012 13
Figure 2-5: Existing Land Use 15
Figure 2-6: Development Projects 17

Figure 3-1: AM Peak Hour Metrorail Entries/Exits by Station Entrance....22
Figure 3-2: PM Peak Hour Metrorail Entries/Exits by Station Entrance....23
Figure 3-3: Extent of Silver Spring Station Model – Metrorail Mezzanine & Ground Level....25
Figure 3-4: Extent of Silver Spring Station Model – Metrorail Platform Level & Transit Center Level 2....25
Figure 3-5: Extent of Silver Spring Station Model – Purple Line Mezzanine Level....26
Figure 3-6: Metrorail Mezzanine Level / Transit Center Level 1....27
Figure 3-7: Metrorail Platform Level /Transit Center Level 2....27
Figure 3-8: Purple Line Mezzanine Level....28
Figure 3-9: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine / Transit Center Level 1....30
Figure 3-10: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform / Transit Center Level 2....31
Figure 3-11: AM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level....32
Figure 3-12: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine / Transit Center Level 1....33
Figure 3-13: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform / Transit Center Level 2....34
Figure 3-14: PM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level....35
Figure 4-1: Existing North Mezzanine and Reconfigured North Mezzanine with New Elevator....41
Figure 4-2: Purple Line-Metrorail Mezzanine Connection Alternative E (Plans)....43
Figure 4-3: Purple Line-Metrorail Mezzanine Connection Alternative E (Sections)....44
Figure 4-4: Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) (Plans)....46
Figure 4-5: Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) (Sections)....47
Figure 5-1: AM Peak Hour Metrorail Entries/Exits by Station Entrance....49
Figure 5-2: PM Peak Hour Metrorail Entries/Exits by Station Entrance....50
Figure 5-3: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine/Transit Center Level 1....52
Figure 5-4: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform/Transit Center Level 2....53
Figure 5-5: AM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level....54
Figure 5-6: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine/Transit Center Level 1....55
Figure 5-7: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform/Transit Center Level 2....56
Figure 5-8: PM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level....57
Figure 5-9: Alternative E - Purple Line Mezzanine Level....58
Figure 5-10: Alternative H (Option D) - Purple Line Mezzanine Level....58

List of Tables

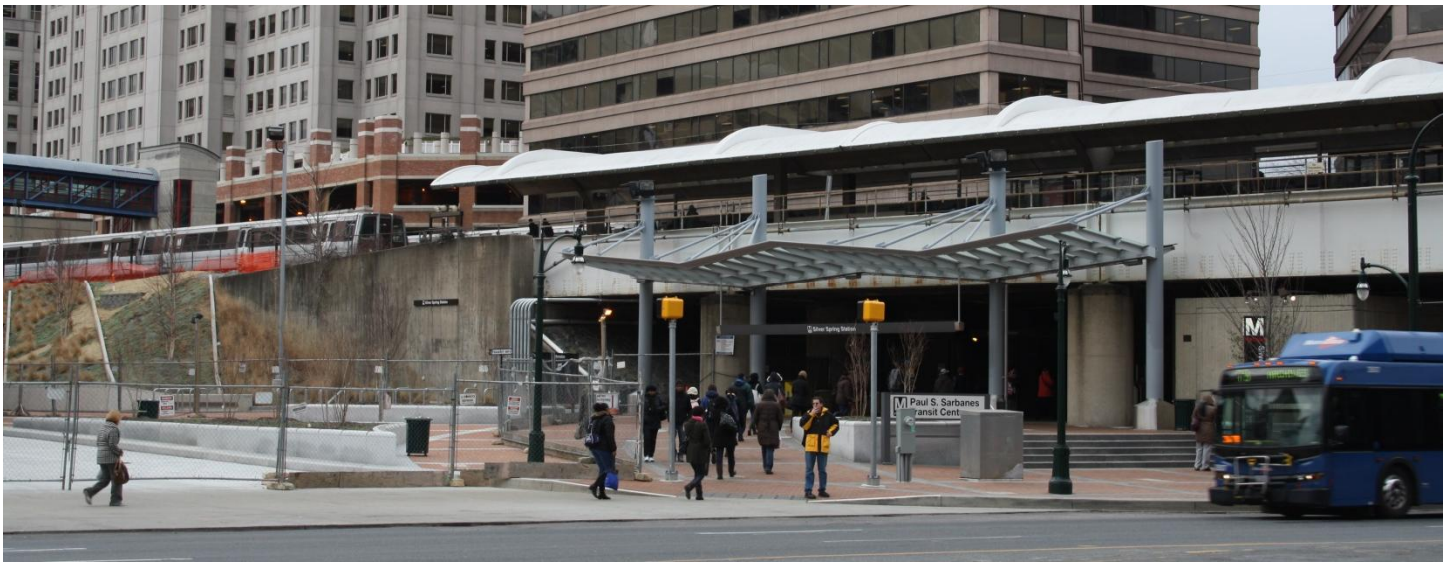
Table 2-1: Station Faregates and Vertical Circulation Capacity....9
Table 2-2: Station Existing Conditions Summary....18
Table 3-1: Population and Employment within 1-mile Radius....19
Table 3-2: Population and Employment Percent Change within 1-mile Radius....19
Table 3-3: Metrorail Red Line Operating Plan at Silver Spring....19
Table 3-4: Silver Spring Metrorail Weekday Boardings....20
Table 3-5: Silver Spring Metrorail Peak Hour Boardings and Alightings....20
Table 3-6: Silver Spring Metrorail Peak Hour Boardings and Alightings – Percent Change....20
Table 3-7: Purple Line Peak Hour Transfers to/from Metrorail Red Line at Silver Spring....21
Table 3-8: AM and PM Peak Hour Zone Density Comparison (LOS E and F)....36
Table 3-9: Combined Peak Hours and Zones Average Density Comparison (LOS E and F)....36
Table 3-10: Vertical Circulation Peak 15 Minutes Average Clearance Times (Minutes:Seconds)....37
Table 4-1: Station Improvement Concepts and Design Process....38
Table 4-2: North Mezzanine Faregate Capacity....40
Table 5-1: AM and PM Peak Hour Zone Density Comparison (LOS E and F)....59
Table 5-2: Combined Peak Hours and Zones Average Density Comparison (LOS E and F)....59

Table 5-3: Vertical Circulation Peak 15 Minutes Average Clearance Times (Minutes:Seconds).....60
Table 5-4: Metrorail-Purple Line Transfers Average AM and PM Peak Hour Journey Times.....60
Table 5-5: Conceptual Capital Cost Estimates.....61
Table 5-6: Design Alternatives Evaluation Matrix.....62

Appendices

Appendix A: North Mezzanine New Elevator Concept Drawings
Appendix B: Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) Concept Drawings
Appendix C: Conceptual Capital Cost Estimates for Improvement Concepts

(This page intentionally left blank)



Executive Summary

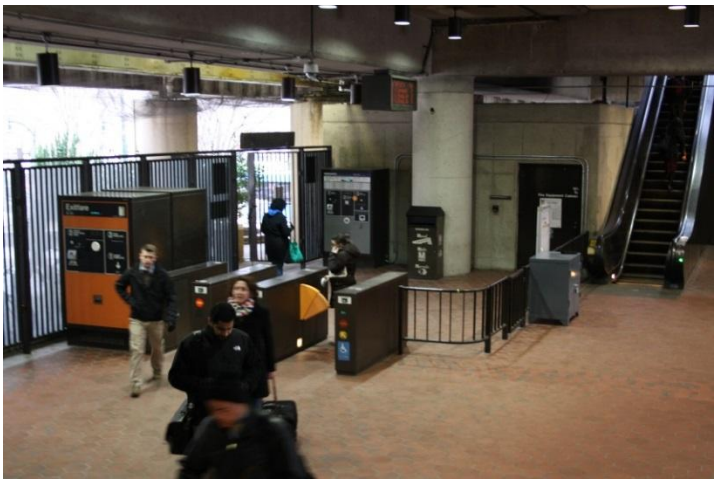
Introduction

This report summarizes the findings and conclusions of the Silver Spring Station Capacity Analysis Study ("the study") conducted by the Washington Metropolitan Area Transit Authority (WMATA or "Metro"). The study assessed current and future station capacity required to accommodate forecast Metrorail ridership growth and transfers to and from the future Purple Line station planned by the Maryland Transit Administration (MTA). The study designed improvement concepts to connect the two stations, address future capacity needs within the Metrorail station, and improve access at the Metrorail station north mezzanine.

Existing Station Conditions

Silver Spring station is a major transportation hub for the Silver Spring area of Montgomery County and adjacent areas of the District of Columbia. The station supports passenger transfers between a variety of modes, including Metrorail, multiple bus providers, and Maryland Area Regional Commuter (MARC) commuter rail.

Currently, Silver Spring Metrorail station operates with no significant crowding during either the AM or PM peak hours. However, ADA faregates are currently used to increase overall passenger throughput at the expense of slowing down passenger movement. During faregate outages or extended delays (e.g., passengers unfamiliar with operation), queues can form. Current station operations would benefit from additional faregate capacity at the northwest, northeast and southwest entrances to provide redundancy in case of faregate outages and to meet Metro standards.



Silver Spring Metrorail Station South Mezzanine, Southwest Entrance Faregates

Future 2020 and 2030 No Build Station Conditions

In 2020, Silver Spring station will serve as a transfer point between Metrorail and the Purple Line light rail transit (LRT) system. Weekday Metrorail boardings at Silver Spring are forecast to increase from 13,600 in 2012 to 25,400 in 2020 and 27,000 in 2030.

Pedestrian model simulations of the future station conditions were developed using Legion SpaceWorks software, based on the ridership forecasts. The modeled future No Build condition included operations at the Metrorail station, MARC platforms, Transit Center bus terminal and the planned Purple Line station, but without a direct mezzanine connection to the Metrorail station.

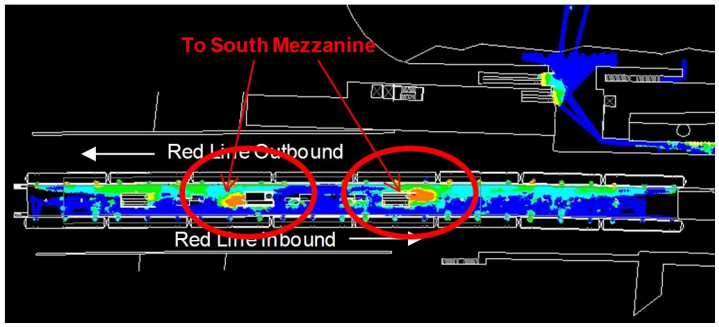
The pedestrian model simulations showed that by 2020, with similar conditions in 2030, high volumes of passengers transferring to the Transit Center and Purple Line via the southeast entrance cause substantial PM peak hour congestion on the Metrorail platform level at the queuing areas of the south mezzanine down escalators (see **Figure ES-1**). Minor congestion occurs at the southeast faregates during both the AM and PM peak hours.

On the Purple Line mezzanine, pedestrian congestion occurs at the queuing area of the down escalator during both AM and PM peaks (see **Figure ES-1**). This congestion is caused by the high volume of unloading Purple Line passengers using only a single escalator and single stair to reach Transit Center level 2.

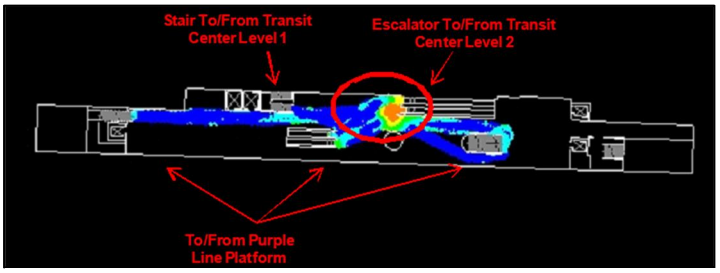
During the spikes of unloading Purple Line passengers, minor congestion also occurs at Transit Center level 2 at the queuing area of the down escalator.

Metrorail Red Line Platform,
Escalators to/from South Mezzanine

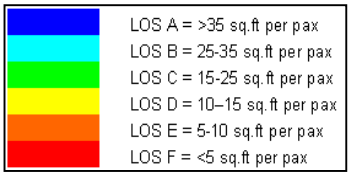
Figure ES-1: 2020 No Build Pedestrian Model Simulation – Cumulative Mean Density Maps



PM Peak 15 Minutes – Metrorail Red Line Platform



AM Peak 15 Minutes – Purple Line Mezzanine Level

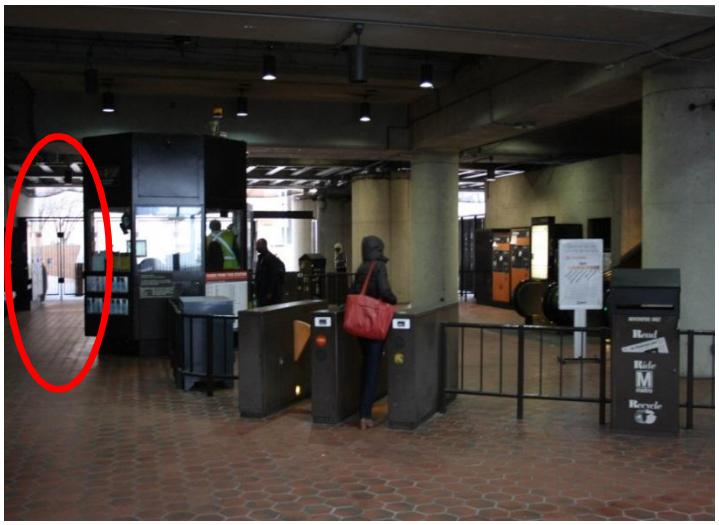


Station Passenger Level of Service (LOS) Key

Station Improvement Design Concepts

North Mezzanine New Elevator

The study developed a concept design for an elevator connecting the Metrorail north mezzanine to the platform. Currently, only a single elevator, located at the south mezzanine, provides elevator access to and from the platform level. The purpose of the proposed improvement is to expand ADA access at the station and provide redundancy for situations when the south mezzanine elevator is out of service. In addition to the elevator, the reconfigured north mezzanine incorporates a new Metro staff break room and additional faregates at each entrance.

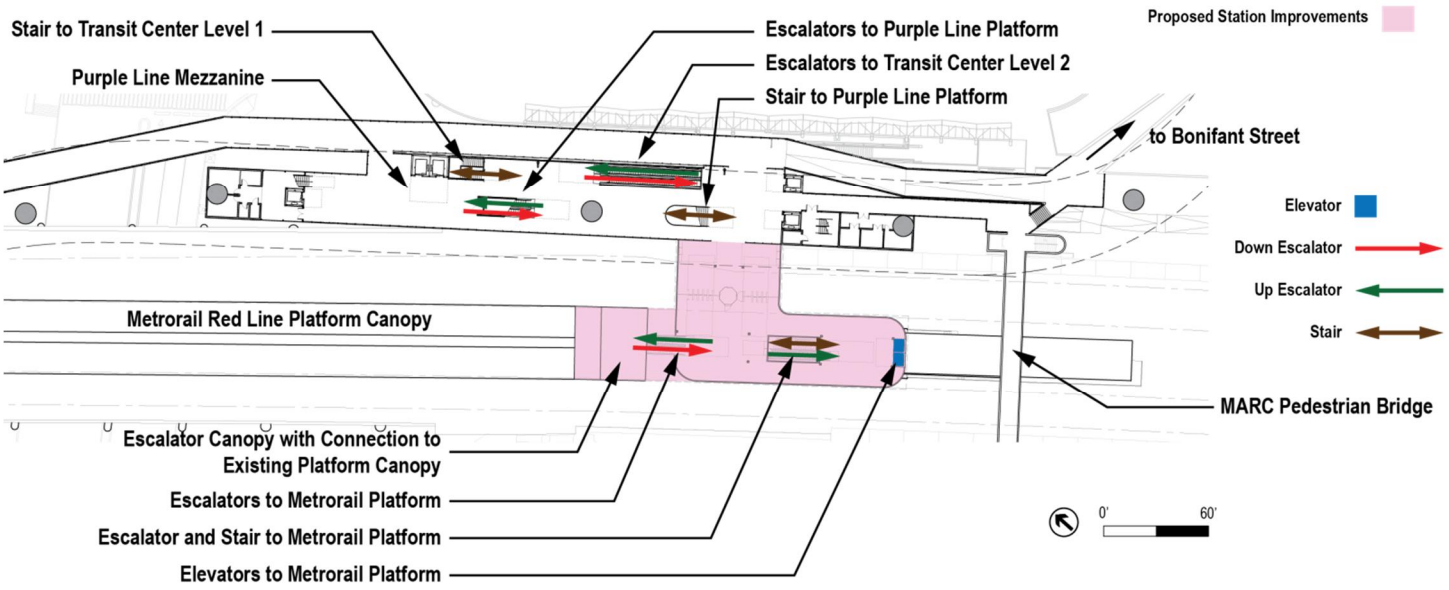


North Mezzanine; location proposed for new elevator

Purple Line-Metrorail Mezzanine Connection

Concept design alternatives for the Purple Line-Metrorail mezzanine were developed based on the location identified in MTA Purple Line station drawings. Two design alternatives (Alternative E and Alternative H (Option D)) were fully developed and selected for pedestrian simulation modeling and evaluation to compare their performance against the 2030 No Build conditions. Alternative H (Option D) has a wider mezzanine that better accommodates the high pedestrian volumes using the new Metrorail entrance provided (see **Figure ES-2**).

Figure ES-2: Purple Line-Metrorail Mezzanine Connection Alternative H (Option D)



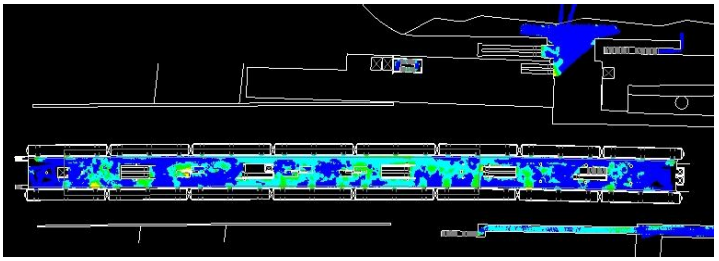
Pedestrian Model Simulations of Design Concepts

Pedestrian model simulations were conducted for the two Purple Line-Metrorail Mezzanine Connection alternatives in the forecast year 2030. The Purple Line-Metrorail Mezzanine Connection, which provides an additional path for passengers to access the Transit Center and Purple Line mezzanine, greatly reduces the extent of high densities at the following areas:

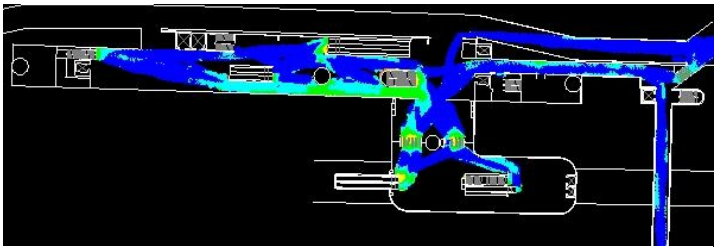
- Southeast entrance faregates;
- South mezzanine escalators on the Metrorail platform level;
- Down escalator from the Purple Line Mezzanine to Transit Center level 2; and
- Down escalator from Transit Center level 1 to ground level.

Figure ES-3 shows the pedestrian model simulations of the station with the Purple Line-Metrorail Mezzanine Connection Alternative H (Option D).

Figure ES-3: 2030 Alternative H (Option D) Pedestrian Model Simulation – Cumulative Mean Density Maps



PM Peak 15 Minutes – Metrorail Red Line Platform



AM Peak 15 Minutes – Purple Line Mezzanine Level and New Metrorail Entrance Mezzanine

Study Recommendations

The station improvement concepts were evaluated based on results of the pedestrian model simulations, cost estimates, and qualitative constructability factors. The Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) best accommodates future Metrorail station ridership growth, facilitates transfer access to and from the Purple Line and Transit Center, and provides an additional access point to the station. Overall, Alternative H (Option D):

- Addresses 2030 No Build condition deficiencies within the Metrorail station;
- Cuts the transfer time between the Purple Line mezzanine and Metrorail platform by half;
- Reduces congestion at the Purple Line mezzanine and Transit Center escalators; and
- Best handles passenger flow through the new Metrorail entrance compared to the other mezzanine connection design alternatives.

The study also identified the following improvements, which could be implemented independently of the Purple Line in the short term, to address existing station access deficiencies:

- A new elevator connecting the north mezzanine to the platform, reconfigured mezzanine layout, and additional faregates; and
- An additional faregate at the southwest entrance to provide redundancy in case of faregate outage and to relieve the existing ADA gate.

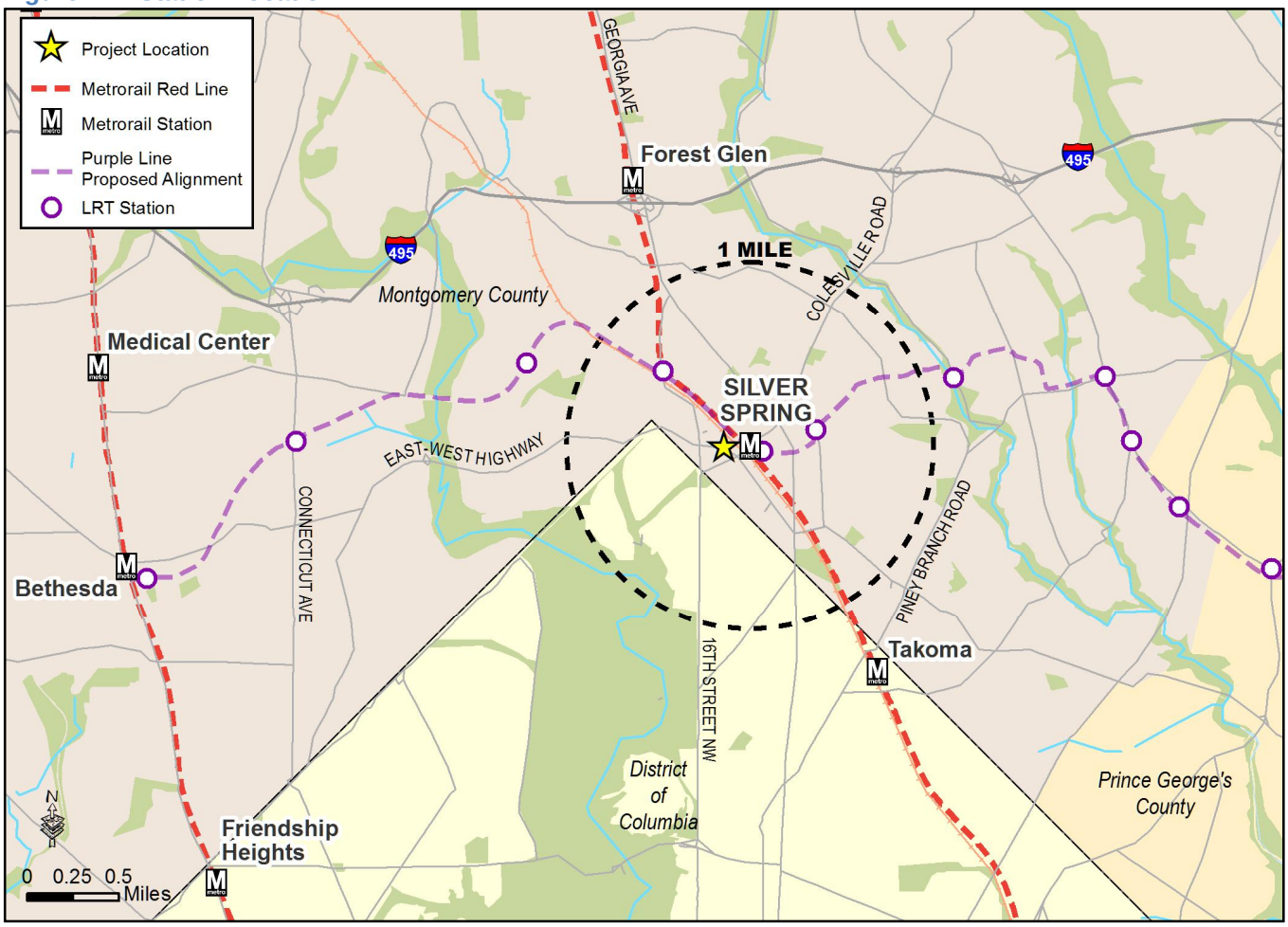
1.0 Introduction

This report summarizes the findings and conclusions of the Silver Spring Station Capacity Analysis Study ("the study") conducted by the Washington Metropolitan Area Transit Authority (WMATA or "Metro"). The study assessed current and future station capacity required to accommodate forecast Metrorail ridership growth and transfers to and from the future Purple Line station planned by the Maryland Transit Administration (MTA) and the Maryland Department of Transportation (MDOT). The study also designed concepts to meet the required future station capacity and to connect the two stations.

1.1 Background

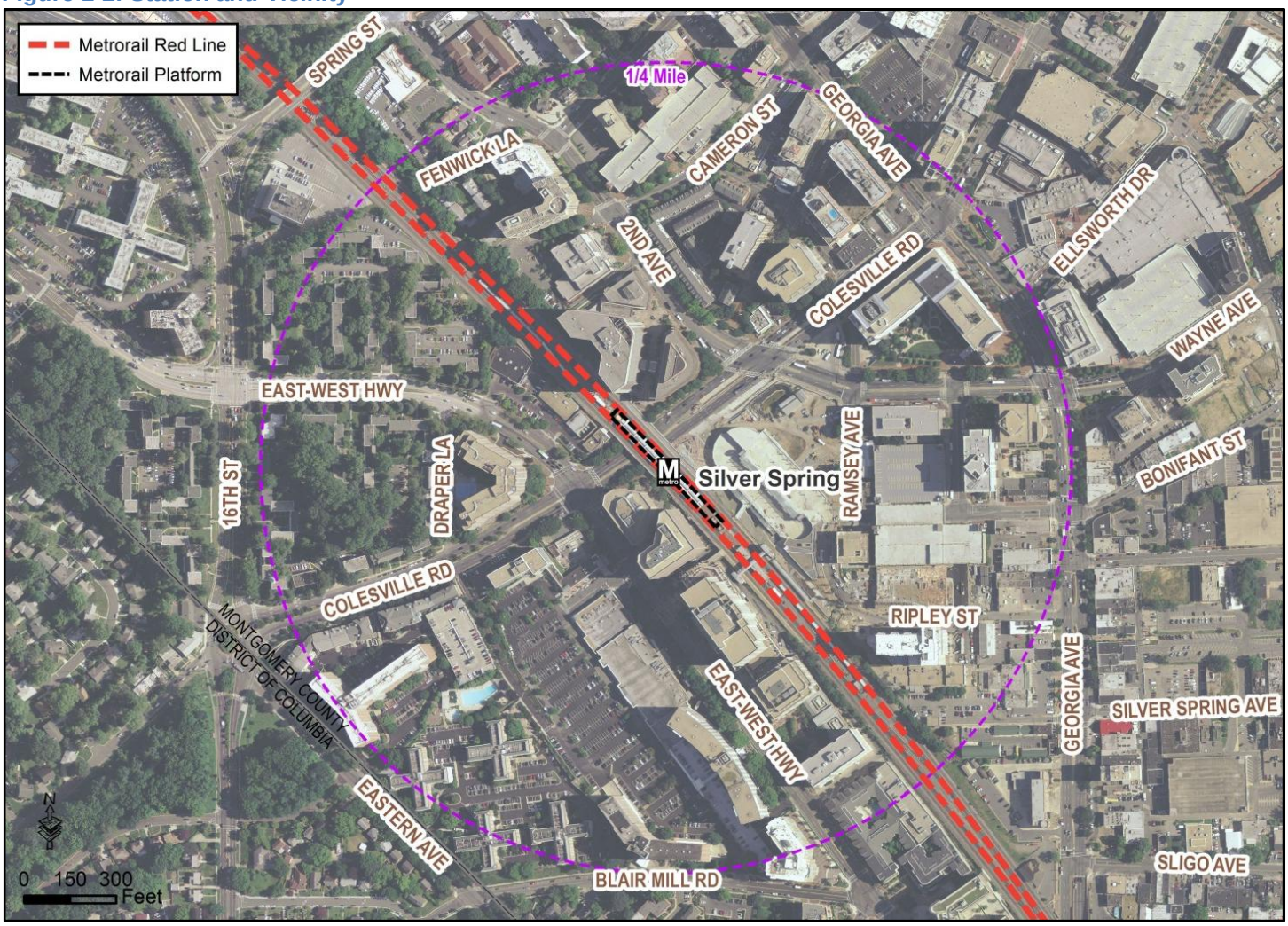
Silver Spring station is located in downtown Silver Spring, Montgomery County, Maryland, just north of the District of Columbia on the Metrorail Red Line (see **Figure 1-1**). The station supports passenger transfers between a variety of modes, including Metrorail, multiple bus providers, and MARC. In 2020, the station will also serve as a transfer point between Metrorail and the Purple Line light rail transit (LRT) system. Additionally, in the near future, bus transit services will be enhanced by the opening of the Silver Spring Transit Center located adjacent to the station. **Figure 1-2** on the following page shows an aerial view of the immediate station area.

Figure 1-1: Station Location



Source: District of Columbia GIS, Montgomery County, Maryland-National Capital Park and Planning Commission (M-NCPPC)

Figure 1-2: Station and Vicinity



Source: DC GIS, Montgomery County, M-NCPPC

1.2 Study Purpose

The purpose of the study is to assess future physical and operational constraints at the station given anticipated ridership growth from forecast population and employment growth in Silver Spring and adjacent areas, as well as the introduction of the Purple Line. The study developed conceptual designs for connecting the Metrorail station to the Purple Line station (consistent with MTA plans) and new elevator access for the station north mezzanine. The analysis included ridership projections and detailed modeling of pedestrian flows, simulating future No Build conditions (with the Purple Line but without Metrorail station improvements) and future Build conditions with conceptual station improvements.

1.3 Report Organization

The final report is organized as follows:

1. Introduction
2. Existing Conditions
3. Future Travel Demand and Station Conditions
4. Station Improvement Concepts
5. Comparison and Evaluation of Design Alternatives
6. Conclusion

2.0 Existing Conditions

2.1 Station Overview

The station is located in downtown Silver Spring on Colesville Road between East-West Highway and Wayne Avenue. **Figure 2-1** shows the station location, major station facilities, and adjacent transportation facilities.

Station Entrance – South Mezzanine, Southeast Entrance

2.1.1 Existing Station Facilities

Existing station facilities are as follows:

- *Metrorail* – two mezzanines, one on either side of Colesville Road, providing station access and vertical circulation to the elevated Red Line platform. Each mezzanine has two entrances, accommodating passenger access from the east and west;
- *Bicycle* – 26 bicycle racks and 30 rentable lockers;
- *Bus* – station bus bays are temporarily relocated to 26 on-street stops on adjacent streets during construction of the new bus Transit Center;
- *Kiss & Ride* – currently no on-site Kiss & Ride facility. A temporary passenger drop-off/pick-up facility is located within the Montgomery County Bonifant-Dixon public parking garage east of the station during construction of the new Transit Center. A new Kiss & Ride facility will be included in the Transit Center; and
- *Park & Ride* – no on-site facility. However, 788 all-day (12-hour) public parking spaces, as well as about 140 additional short-term parking spaces, are available for Metrorail users and the general public in the adjacent Montgomery County Bonifant-Dixon parking garage (Montgomery County website, 2013).

2.1.2 Metrorail Station Layout

Figure 2-2 illustrates the general Metrorail station layout and relationship with the adjacent transit facilities, including the MARC platforms, Transit Center, and planned location of the Purple Line station. **Figure 2-3** illustrates the detailed layouts of the two Metrorail mezzanines and platform.

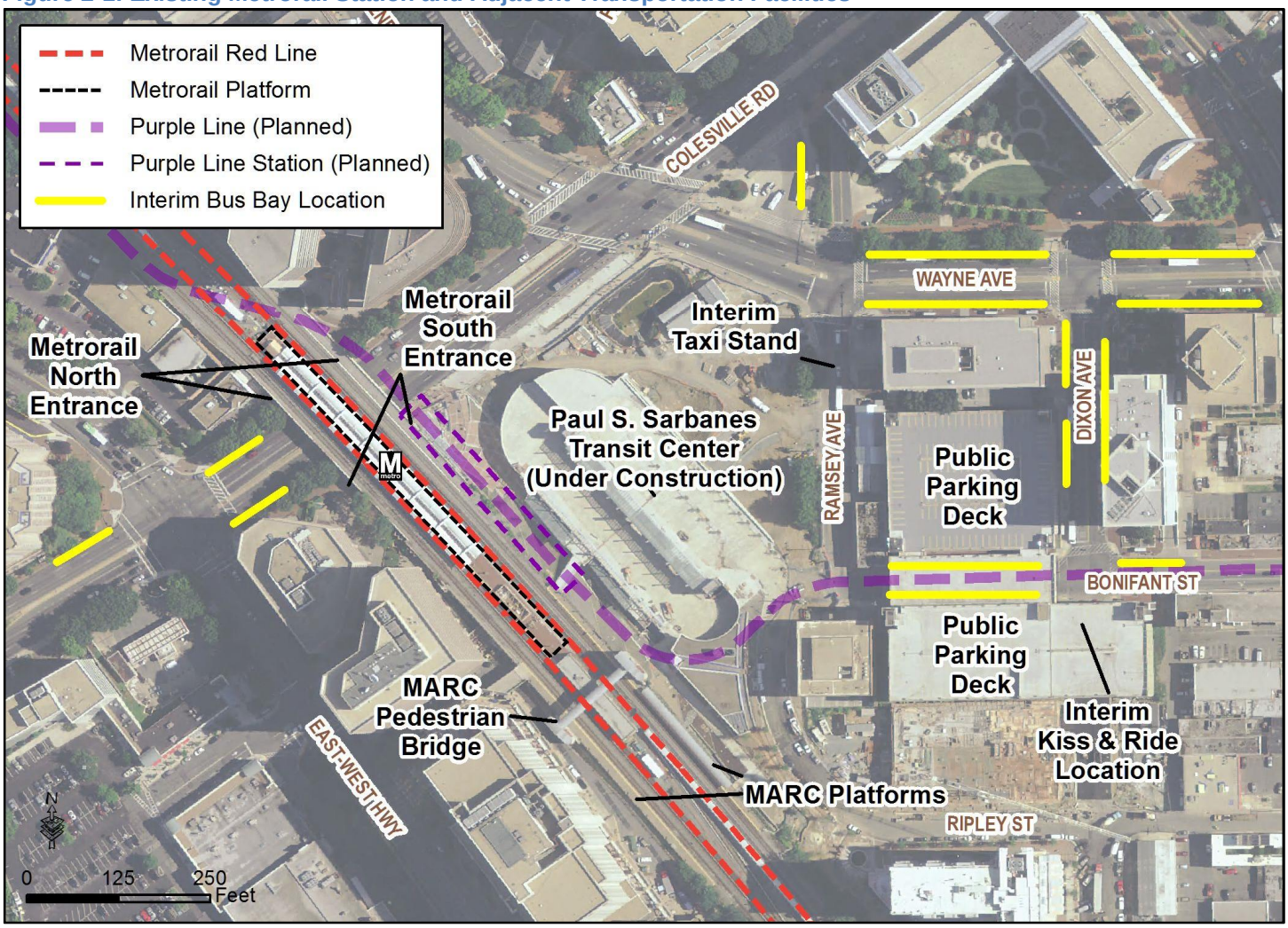
Mezzanine Level

The station has two entrance mezzanines, the north mezzanine and south mezzanine, located at grade level on either side of Colesville Road under the elevated station platform. Each mezzanine has two entrances with separate fare gate arrays serving the east and west sides. Inside each mezzanine are a station manager's kiosk, fare machines, wayfinding information, and vertical circulation elements that provide access to the station platform.

Table 2-1 summarizes the current station mezzanine capacity.

South Mezzanine Faregates (Southeast Entrance)

Figure 2-1: Existing Metrorail Station and Adjacent Transportation Facilities



Source: DC GIS, Montgomery County, M-NCPPC, MTA

Table 2-1: Station Faregates and Vertical Circulation Capacity

Mezzanine	Faregates		Vertical Circulation	
	Standard	ADA	Escalator	Elevator
South Mezzanine *Southeast Entrance*	9	1	3	1
Southwest Entrance	2	1		
North Mezzanine *Northeast Entrance*	2	1	2	0
Northwest Entrance	2	0		

Station Vertical Circulation to Platform (South Mezzanine)

Figure 2-2: Silver Spring Metrorail Station General Layout with Adjacent Facilities

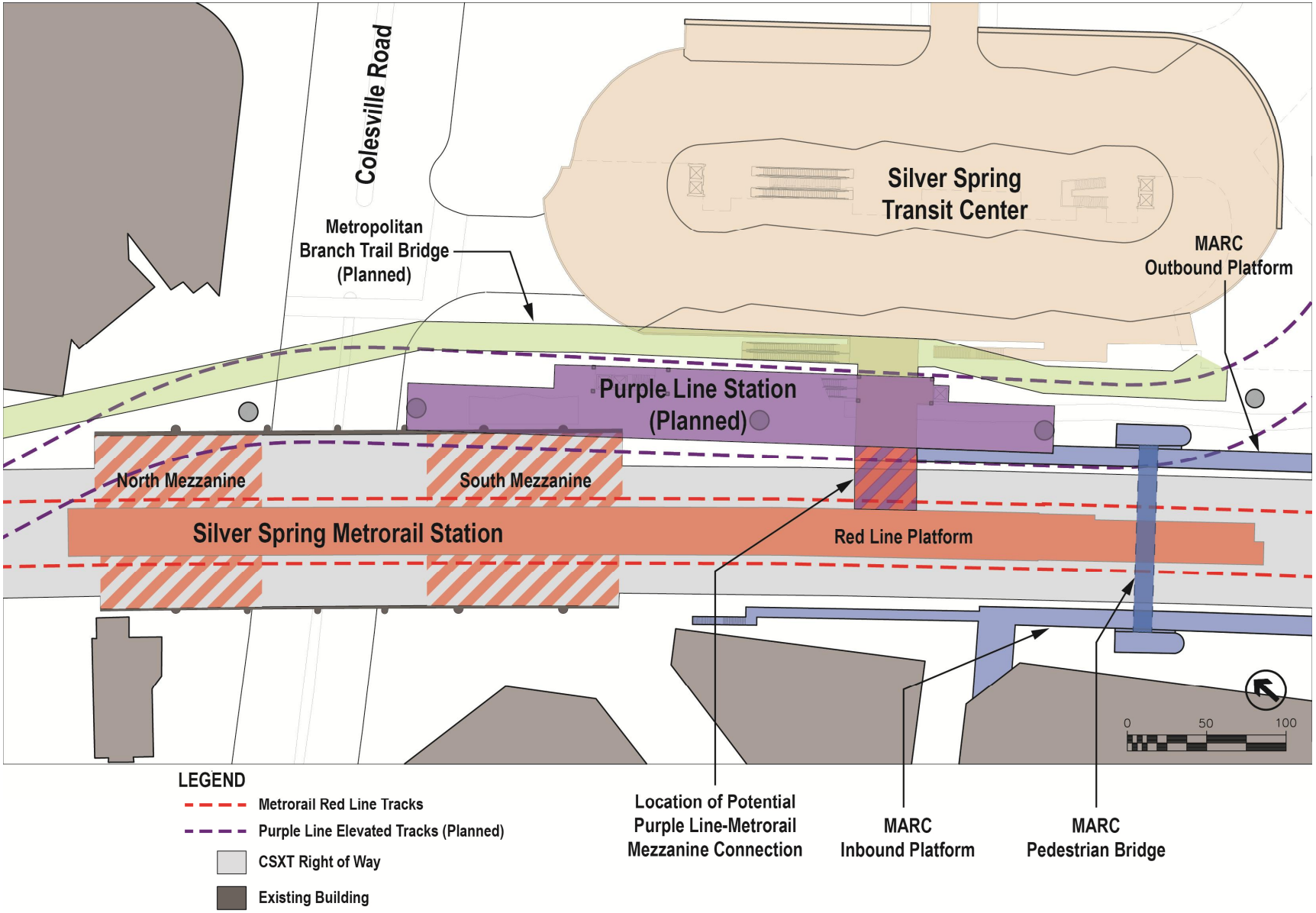
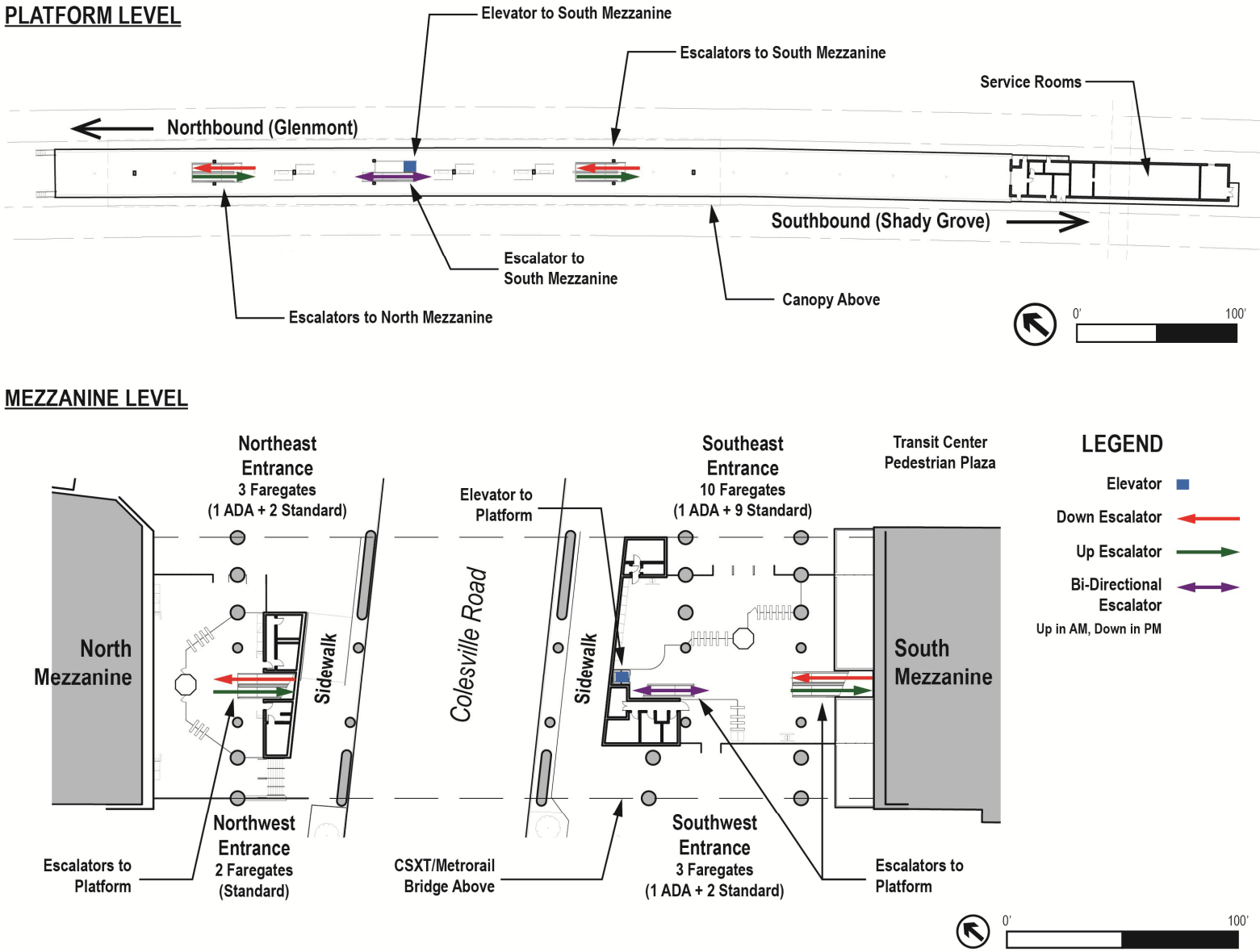


Figure 2-3: Metrorail Station Layouts of Platform and Mezzanine Levels



Platform Level

The Metrorail platform is elevated with a center platform layout. The three banks of escalators and the elevator connect to the northern half of the platform. A canopy covers most of the northern portion of the platform; approximately 180 feet at the southern end of the platform is uncovered.

Station Platform (Looking South)

2.1.3 Metrorail Operations and Ridership

Currently, the Red Line operates at an average three-minute headway during the peak periods. Fifty percent of Red Line trains currently terminate at Silver Spring, while the other trains terminate at Glenmont. Throughout the day, WMATA operates about 50 percent six-car trains and 50 percent eight-car trains along the Red Line.

In 2013, average weekday boardings at Silver Spring Metrorail Station were 13,057, the 15th highest number of boardings in the Metrorail system (WMATA faregate data, FY 2013).

2.1.4 Transfer Services

The station area is well served by mass transit due to its status as a major transfer point between transit systems.

MARC Commuter Rail

The MARC Silver Spring station is located adjacent to the Metrorail station. The MARC Brunswick Line uses the CSXT Metropolitan Subdivision rail tracks, which run parallel to the Metrorail Red Line tracks at the station and south into the District of Columbia. The north and south MARC platforms are accessible via grade level walkways outside of the Metrorail south entrance and are also connected by a pedestrian bridge.

Bus Services

More than 40 bus lines serve the station, including:

- Metrobus (approximately 25 routes)
- Montgomery County Ride On (approximately 20 routes)
- MTA commuter buses (two routes)
- University of Maryland shuttle buses

Major Pedestrian/Bicycle Facilities

The Metropolitan Branch Trail (MBT) is a multi-use trail that connects Silver Spring with downtown DC (terminating at Union Station). The trail links to the Silver Spring station using surface streets and pedestrian paths along the east side of the CSXT tracks.

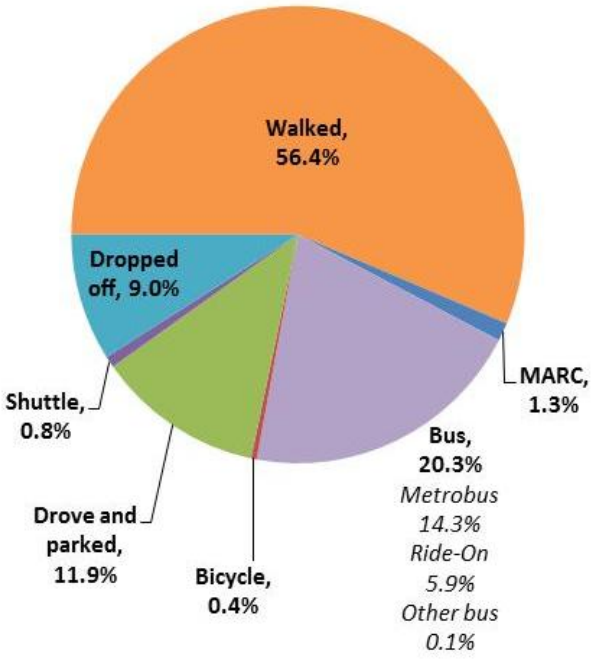
In the future, in conjunction with construction of the Purple Line, the MBT will connect directly to the Purple Line station mezzanine via a planned bridge extending from Ripley Street north over Colesville Road. North and west of the station, the Purple Line and MBT plans call for providing a direct MBT off-street connection to the Georgetown Branch Trail, which links Silver Spring to Bethesda.

2.1.5 Station Access

Access Mode Share

To access the station, the majority (56 percent) of passengers walk, while 20 percent of passengers use bus, and the remaining 23 percent use other modes (WMATA Metrorail Passenger Survey, 2012). **Figure 2-4** summarizes the station access mode share in 2012.

Figure 2-4: Station Mode Access Share, 2012



Source: 2012 WMATA Metrorail Passenger Survey

Pedestrian Routes and Accomodations

The heaviest pedestrian movement in the AM peak (8:00-9:00 am) is passengers accessing the station from the southeast entrance via the east side of the station (closest to the temporary bus stops) and going up the south escalator. In the PM peak (5:00-6:00 pm), no dominant pedestrian movement was observed in the south mezzanine: travelers utilized both down escalators and all faregates about equally. Streets in the vicinity of the station generally have sidewalks on both sides, and most intersections and crosswalks and wheelchair ramps; however, proximate streets to the station, such as Colesville Road and East-West Highway, experience high vehicular traffic volumes throughout the day.

2.1.6 Planned Adjacent Transit Facilities and Services

Planned improvements and transportation services in the immediate station vicinity include:

Silver Spring Paul S. Sarbanes Transit Center

The multi-modal Transit Center is under construction adjacent to the Metrorail station. Current Montgomery County plans for the facility have 32 bus bays for Metrobus, MetroAccess, Ride-on, MTA commuter bus, and shuttle services on the first two levels. The third level will have a Kiss & Ride facility (Montgomery County website, 2013). Completion and opening of the facility has been delayed. Although Montgomery County does not currently have a scheduled opening date for the facility, for the purposes of this study, the facility is assumed to be in full operation by the 2020 near-term forecast year with all on-street bus stops in the immediate vicinity of the Metrorail station relocated to the Transit Center.

Silver Spring Transit Center – Viewed from intersection of Colesville Road and Wayne Avenue/2nd Avenue

Purple Line Silver Spring Station

MTA is planning the Purple Line, a 16-mile light rail line, extending from Bethesda to New Carrollton, with a station adjacent to the Silver Spring Metrorail Station. MTA anticipates that the line will be in operation by 2020 (MTA "Purple Line Facts", 2013). The Purple Line Silver Spring station will be an aerial station located between the Metrorail station and the Transit Center, with pedestrian access from the south side of Colesville Road via the Transit Center vertical circulation elements.

The Purple Line Silver Spring station plans by MTA reserve space for a mezzanine connection (to be built by others) between the Purple Line station mezzanine level and Metrorail platform (see **Figure 2-2**). The Purple Line-Metrorail mezzanine connection would cross over the CSXT tracks and Metrorail northbound track, provide a separate Metrorail fare gate entrance, and connect to the south end of the Metrorail platform via vertical circulation elements. Without the mezzanine connection, passengers transferring from the Purple Line to Metrorail would have to descend 80 feet from the Purple Line platform to ground level, enter the existing Metrorail south entrance at Colvesille Road, and ascend one level to the Metrorail Red Line platform.

The Purple Line mezzanine connection would benefit other station users in addition to those transfering between the Purple Line and the Red Line:

- Transit Center passengers alighting buses on level 2 would have the option to use the mezzanine connection to access Metrorail;
- Metrorail riders accessing the Metrorail station on foot from the southeast and from the Kiss & Ride facility on level 3 of the Transit Center would have a shorter connection to the Red Line platform than entering at Colesville Road;
- Station users with mobility impairments could avoid the grade change from Colesville Road areas southeast of the station; and
- Internal Metrorail station users would benefit by the additional entrance relieving heavy use of the south mezzanine and central platform area.

Section 4 of this report includes conceptual designs developed by this study for the proposed Purple Line-Metrorail mezzanine connection.

2.2 Station Area and Planning Context

2.2.1 Station Area Land Use

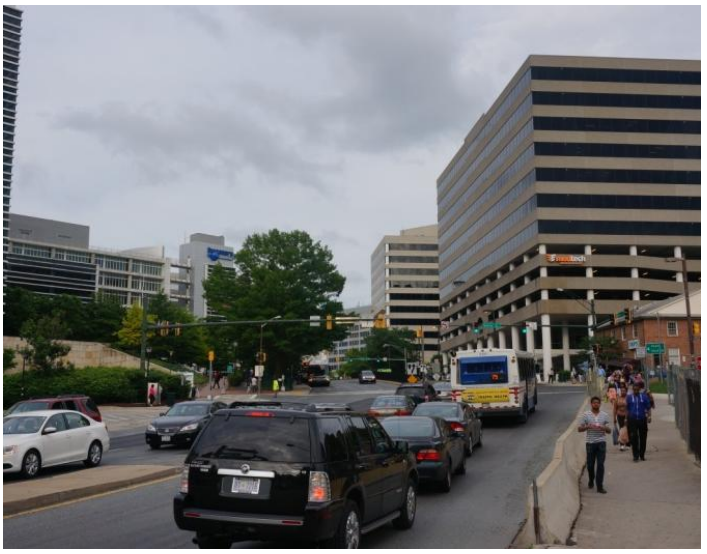
Downtown Silver Spring and the blocks surrounding the Metrorail station are made up primarily of office developments with some street level retail. The office uses include several headquarters of private companies, including United Therapeutics and Discovery Communications, as well as public agencies such as the National Oceanic and Atmospheric Administration (NOAA). The quarter-mile radius from the station also includes several large medium-to-high density residential and retail complexes. The adjacent photos show some development and the streetscape in the immediate vicinity of the station. **Figure 2-5** on the following page shows existing land use in the quarter-mile station area.

Colesville Road at Wayne Avenue looking east

The mix of commercial and medium-density residential uses generally extends out to the half-mile radius, beyond which the land use transitions to mostly low-density residential units. Overall, the District of Columbia portion of the station area is predominantly single-family residences, while the Montgomery County portion has a mix of land uses and densities.

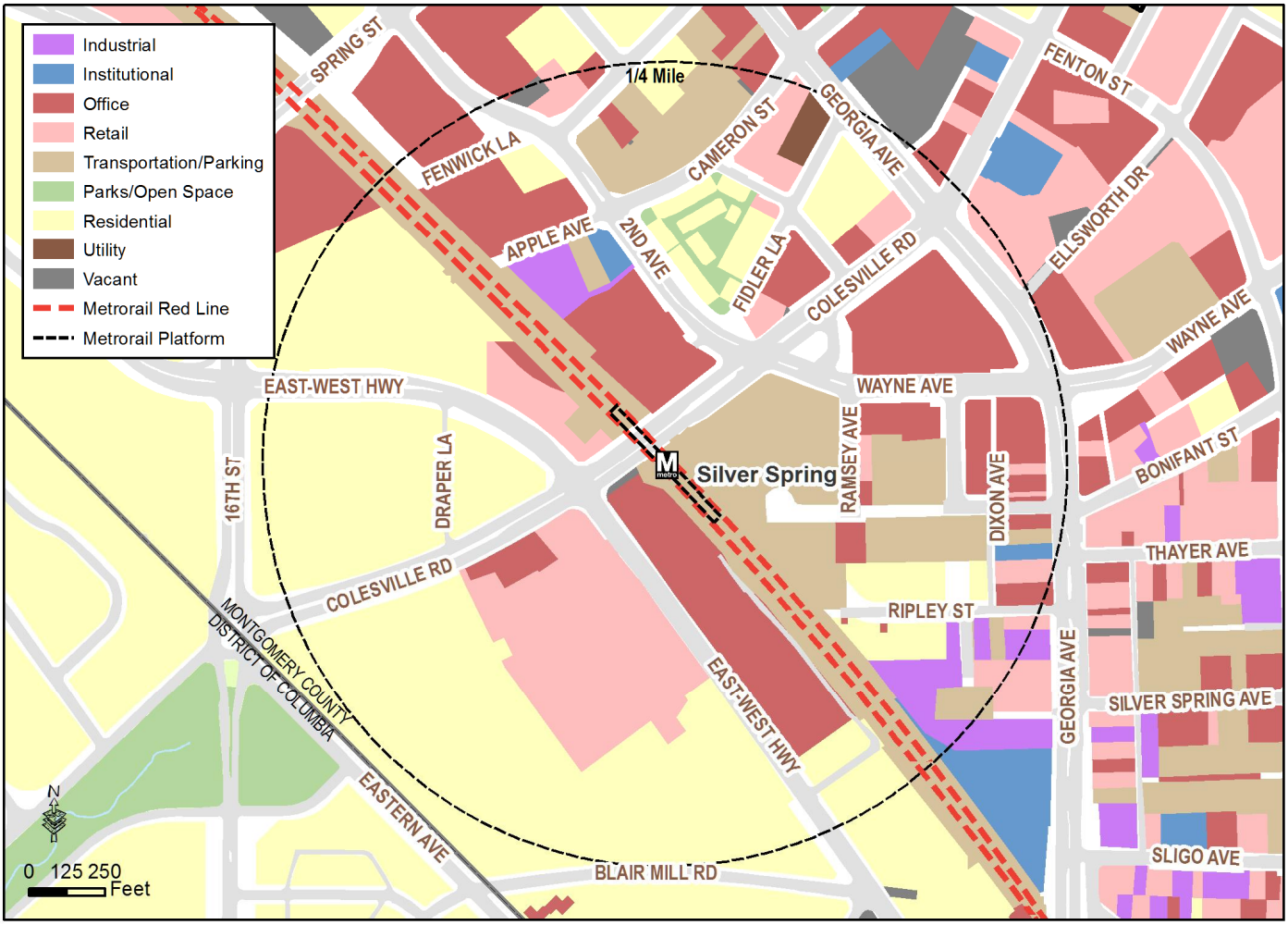
Section 3 describes future station area population and employment changes.

East-West Highway at Colesville Road looking west



Wayne Avenue looking east toward Ramsey Avenue

Figure 2-5: Existing Land Use



Source: DC GIS, Montgomery County, M-NCPPC, and field observations

2.2.2 Station Area Plans

Small area plans for Downtown Silver Spring recommend additional mixed-use residential-commercial development to complement the heavy office use concentration, as well as a general intensification of uses. These plans are summarized below.

Silver Spring CBD Sector Plan (M-NCPPC, 2000)

The plan calls for a wider mix of land uses and building designs in Downtown Silver Spring and recommends flexibility in zoning codes that encourages maximum investment by developers. The plan also proposes an overlay district that would allow for density transfers from demolished buildings.

Purple Line Transit-Oriented Development Assessment (MDOT, 2003)

The study identified opportunities and challenges to create and revitalize activity centers along the Purple Line. At Silver Spring, the report called for fostering a more pedestrian-friendly station area through traffic calming and urban design measures.

2.2.3 Development Projects

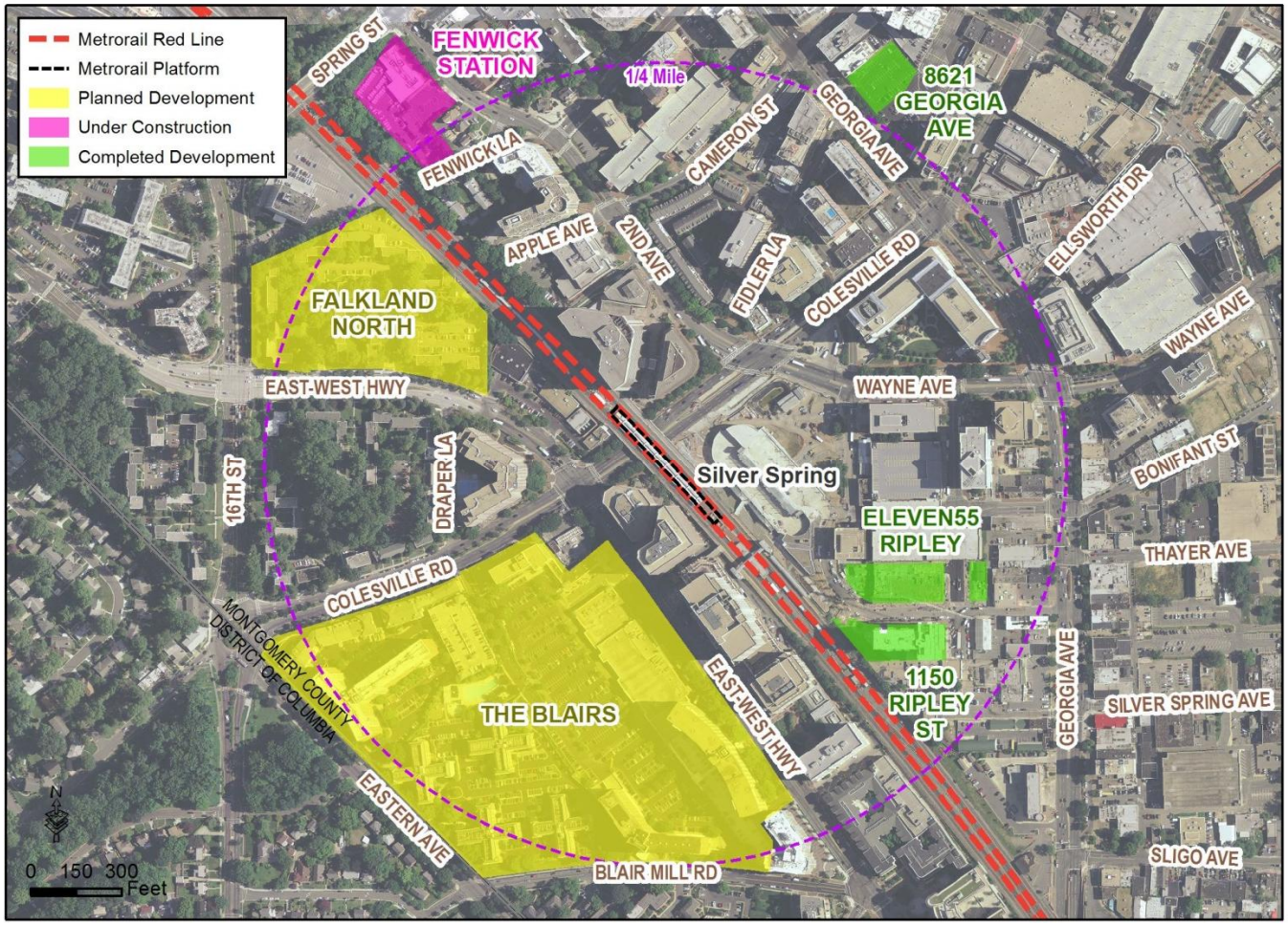
Several large, mixed-use projects are planned, under construction, or recently completed and currently leasing within a quarter-mile of the station (shown in **Figure 2-6**). These projects are expected to contribute to increased Metrorail station demand in the short- and long-term. The recently completed projects and projects under construction consist primarily of mid- and high-rise residential developments, several with ground floor retail.

Significant planned projects include:

- *The Blairs* – proposed development of 10 new apartment blocks (1,400 units), and 450,00 square feet of commercial and office space, hotel towers, four acres of new parks, and a new street grid that would replace the current shopping center, offices, and older buildings west of the Metrorail station across East-West Highway (*expected opening: no date specified; phased implementation over two to three decades currently planned*);[1] and
- *Falkland North* **–** planned project northwest of the Metrorail station, consisting of two 13-story buildings and two eight-story buildings, including 60,000 square feet of retail space and 1,250 residential units (*expected opening: unknown*).[2]

[1] Sernovitz, Daniel. 2012. "Tower Cos. To launch major redevelopment of The Blairs in Silver Spring." Washington Business Journal, February 13. Accessed May 2013. http://www.bizjournals.com/washington/breaking_ground/2013/02/tower-cos-to-launch-major.html?page=all.
[2] JBG Rosenfeld Retail. 2013, Accessed May 2013. http://www.jbgr.com/images/inner/properties/FalklandNorth.pdf.

Figure 2-6: Development Projects



Source: DC GIS, Montgomery County, M-NCPPC, and project-specific information (see References)

2.3 Existing Station Conditions

Currently, Silver Spring Metrorail station operates with no significant crowding during either the AM or PM peak hours. However, ADA faregates are currently used to increase overall passenger throughput at the expense of slowing down passenger movement. During faregate outages or extended delays (e.g., passengers unfamiliar with operation), queues can form. In addition to field observations, a pedestrian model simulation of current station conditions was used to test situations in which faregates are out of service at the northwest, northeast and southwest entrances. The simulation was conducted for the PM peak period when passengers from unloading trains arrive at the faregates in groups. The simulations showed that, under current conditions, out of service faregates would result in mezzanine congestion and queues.

Table 2-2 summarizes existing station conditions.

Table 2-2: Station Existing Conditions Summary

Station Element	Existing Conditions
Platform	• No significant crowding observed • Passengers concentrated in northern two-thirds of platform near escalators and under canopy
Vertical Circulation Elements	• No significant vertical circulation capacity deficiencies observed • Minor queues in PM peak at north mezzanine down escalator; however, shift of bus transfers to the Transit Center is expected to improve the escalator clearance time • North mezzanine lacks redundancy in case of escalator outage
Faregates	• No significant queuing observed • Additional faregate needed at NE, NW, and SW entrances for redundancy in case of faregate outages and to meet WMATA standards
ADA Access	• North mezzanine lacks platform elevator • Additional ADA access to platform needed to provide redundancy in case of elevator outage
Station Area Access	• No deficiencies observed in pedestrian accommodations or significant conflicts between pedestrians and vehicles observed in the station vicinity • Changes in traffic and pedestrian circulation patterns and potential pedestrian-vehicle conflicts in the station vicinity should be monitored upon the opening of the Transit Center given the high vehicular traffic volumes on Colesville road and other adjacent streets

Current station operations would benefit from additional faregate capacity at the northwest, northeast and southwest entrances to provide redundancy in case of faregate outages and to meet Metro standards. Note that Metro does not have a stock of extra faregates available, and that additional faregates at Silver Spring station would need to be pulled from other Metrorail stations. Otherwise, their addition would have to wait until implementation of the planned new fare system.

3.0 Future Travel Demand and Station Conditions

This section describes forecast land use and ridership changes at the station, which include transfers from the planned Purple Line. In the future, the station will experience significant ridership growth due to land use changes as well as the introduction of the Purple Line. The growth in passenger volumes and loads on faregates and vertical circulation will be concentrated at the south mezzanine, especially the southeast entrance, due to the locations of the Transit Center and Purple Line station on the southeast side of the Metrorail station. Without station improvements, such as a new entrance to connect to the Purple Line station, the growth in demand will result in the need for one additional escalator and increased faregate capacity at the south mezzanine.

3.1 Forecast Travel Demand

Travel demand at Silver Spring Metrorail station will increase significantly in the future due to land use changes and the introduction of Purple Line service. Future boardings and transfer movements have the potential to affect the capacity of station fare gates, vertical circulation elements (VCEs), platform, and other circulation areas. This section summarizes existing and forecast 2020 and 2030 Metrorail boardings, alightings and transfers to/from the Purple Line.

3.1.1 Future Station Area Land Use

Within the station area of downtown Silver Spring, both population and employment are forecast to grow as development become denser and the CBD continues evolving into a mixed-use activity center. These land use trends are factors in the general increased station demand. **Table 3-1** and **Table 3-2** summarize the projected population and employment changes in the station area, according to the MWCOG Round 8.1 Cooperative Land Use Forecast.

Table 3-1: Population and Employment within 1-mile Radius

	2012	2020	2030
Population	34,084	44,803	45,643
Employment	35,077	38,306	42,019

Source: MWCOG Round 8.1 Land Use Forecast

Table 3-2: Population and Employment Percent Change within 1-mile Radius

	2012-2020	2020-2030	2012-2030
Population	24%	2%	25%
Employment	8%	9%	17%

Source: MWCOG Round 8.1 Land Use Forecast

3.1.2 Metrorail Service Assumptions

The current and planned future Metrorail Red Line operations at Silver Spring station are summarized in **Table 3-3**.

Table 3-3: Metrorail Red Line Operating Plan at Silver Spring

Operations	2012	2020	2030
Average Combined Headway (Peak period, peak direction)	3 min.	3 min.	3 min.
Turn-back Trains	50% turn-back trains at Silver Spring	50% turn-back trains at Silver Spring	100% trains terminate at Glenmont
Percentage of 8-car Trains	50%	100%	100%

Note: The plan assumes that Metro would have enough expansion fleet by 2030 to eliminate the turnback on the Red Line.
Source: WMATA Metrorail Operating Plan, February 2013.

By 2020 the Purple Line is assumed to be in operation at Silver Spring, and transfers to and from Metrorail are included in the 2020 and 2030 ridership forecasts.

3.1.3 Metrorail Ridership

Future Metrorail ridership and Purple Line transfers in 2020 and 2030 were forecast using the WMATA Regional Transit System Plan (RTSP) Model with MWCOG Round 8.1 Cooperative Land Use Forecast population and employment data. Adjustments to the travel demand model outputs were made using the Line Load application, which assigns 30-minute mezzanine counts to Metrorail station entries and exits and summarizes the boardings and alightings by time of day. Metrorail Red Line boardings and alightings and Purple Line transfers are summarized below.

Metrorail Red Line Boardings and Alightings

Metrorail boardings at Silver Spring station are forecast to increase significantly between 2012 and 2020 and then level off between 2020 and 2030 (see **Table 3-4**).

Table 3-4: Silver Spring Metrorail Weekday Boardings

Period	2012	2020	2030
Peak Period Boardings	8,600	15,800	15,800
Off-Peak Boardings	5,000	9,700	11,200
Total Weekday Boardings	13,600	25,400	27,000

Notes: Peak Period = 6:00am-9:00am and 3:00pm-7:00pm; forecast assumes operation of the Purple Line by 2020
Source: 2012 Faregate data; WMATA RTSP Model

Peak hours for total boardings and alightings at Silver Spring station are 8:00am-9:00am and 5:00pm-6:00pm. **Tables 3-5** and **3-6** summarize peak hour boardings and alightings at Silver Spring. By 2020, AM peak hour boardings are projected to increase by almost 50 percent from current conditions. Between 2020 and 2030, however, AM peak hour boardings are forecast to decrease by 15 percent, while PM peak hour boardings are forecast to increase by 25 percent.

Table 3-5: Silver Spring Metrorail Peak Hour Boardings and Alightings

Peak Hour / Movement		2012	2020	2030
AM Peak Hour	Boardings	2,680	5,140	4,450
	Alightings	930	1,570	2,080
PM Peak Hour	Boardings	1,080	1,720	2,300
	Alightings	2,260	4,430	3,960

Notes: AM Peak Hour = 8:00am-9:00am; PM Peak Hour = 5:00pm-6:00pm; forecast assumes operation of the Purple Line by 2020
Source: 2012 Faregate data; WMATA RTSP Model with Line Load adjustment

Table 3-6: Silver Spring Metrorail Peak Hour Boardings and Alightings – Percent Change

Peak Hour / Movement		2012-2020	2020-2030	2012-2030
AM Peak Hour	Boardings	48%	-15%	40%
	Alightings	41%	25%	56%
PM Peak Hour	Boardings	37%	25%	53%
	Alightings	49%	-12%	43%

Notes: AM Peak Hour = 8:00am-9:00am; PM Peak Hour = 5:00pm-6:00pm; forecast assumes operation of the Purple Line by 2020
Source: 2012 Faregate data; WMATA RTSP Model with Line Load adjustment

The forecast decrease in Metrorail peak hour/peak direction boardings and alightings between 2020 and 2030 may have several causes, including the general increase in employment forecast by MWCOG for Montgomery County, with potentially fewer people commuting from the Silver Spring area to downtown DC.

Although peak period Metrorail boardings do not increase significantly between 2020 and 2030, off-peak Metrorail boardings increase 16 percent during this time period. Off-peak period ridership is mainly affected by non-work trips, which are forecast to increase near Silver Spring station between 2020 and 2030, as more people are living and working in this area by 2030 (although fewer may be commuting to downtown DC).

Purple Line Transfers to Metrorail

The station is expected to have a high volume of transfers between the Purple Line and Metrorail. **Table 3-7** summarizes the peak hour transfers.

Table 3-7: Purple Line Peak Hour Transfers to/from Metrorail Red Line at Silver Spring

Peak Hour / Movement		2020	2030
AM Peak Hour	To Red Line	1,261	1,314
	From Red Line	210	277
PM Peak Hour	To Red Line	210	277
	From Red Line	1,261	1,314

Note: AM Peak Hour = 8:00am-9:00am; PM Peak Hour = 5:00pm-6:00pm
Source: WMATA RTSP Model with Line Load adjustment

3.2 Changes in Station Access Related to New Transit and Pedestrian/Bicycle Facilities

By 2020, passenger flows within Silver Spring Metrorail Station and transfers to surface transit services will change significantly. The opening of the Transit Center bus terminal and introduction of Purple Line service will shift many station entries and exits to the south mezzanine southeast entrance. The Transit Center will consolidate bus operations in a single location and will also include a Kiss & Ride facility on its top level.

In addition to the shift in passenger movements expected from the planned adjacent transit facilities, new pedestrian and bicycle facilities connecting to the southeast side of the Metrorail station will also result in increased Metrorail access from the southeast entrance. The recently constructed walkway from Bonifant Street to the Metrorail southeast entrance, between the Transit Center and the CSXT tracks, may draw more users as construction of the Transit Center is completed and new developments built southeast of the station become fully occupied. A planned Georgetown Branch Trail bridge, to be built in conjunction with the Purple Line, will provide a grade-separated direct connection over Colesville Road to the station for pedestrians and bicyclists from areas northwest of the station; the trail will connect to the Purple Line mezzanine.

Figure 3-1 and **Figure 3-2** on the following pages illustrate Metrorail passenger entry and exit volumes by station entrance during the AM and PM peak hours, respectively, for existing conditions (2012) and future No Build conditions (2020 and 2030).

Figure 3-1: AM Peak Hour Metrorail Entries/Exits by Station Entrance

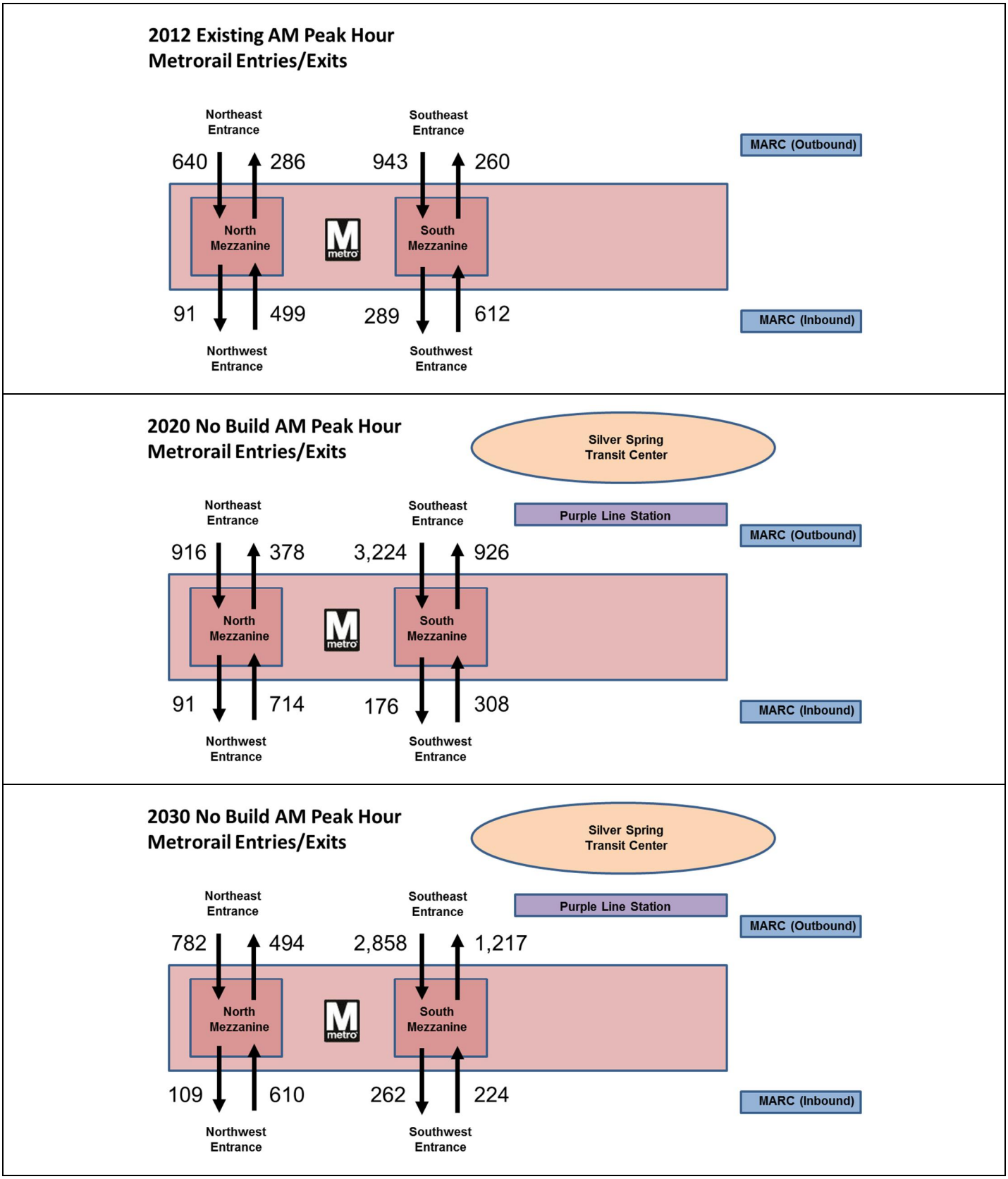
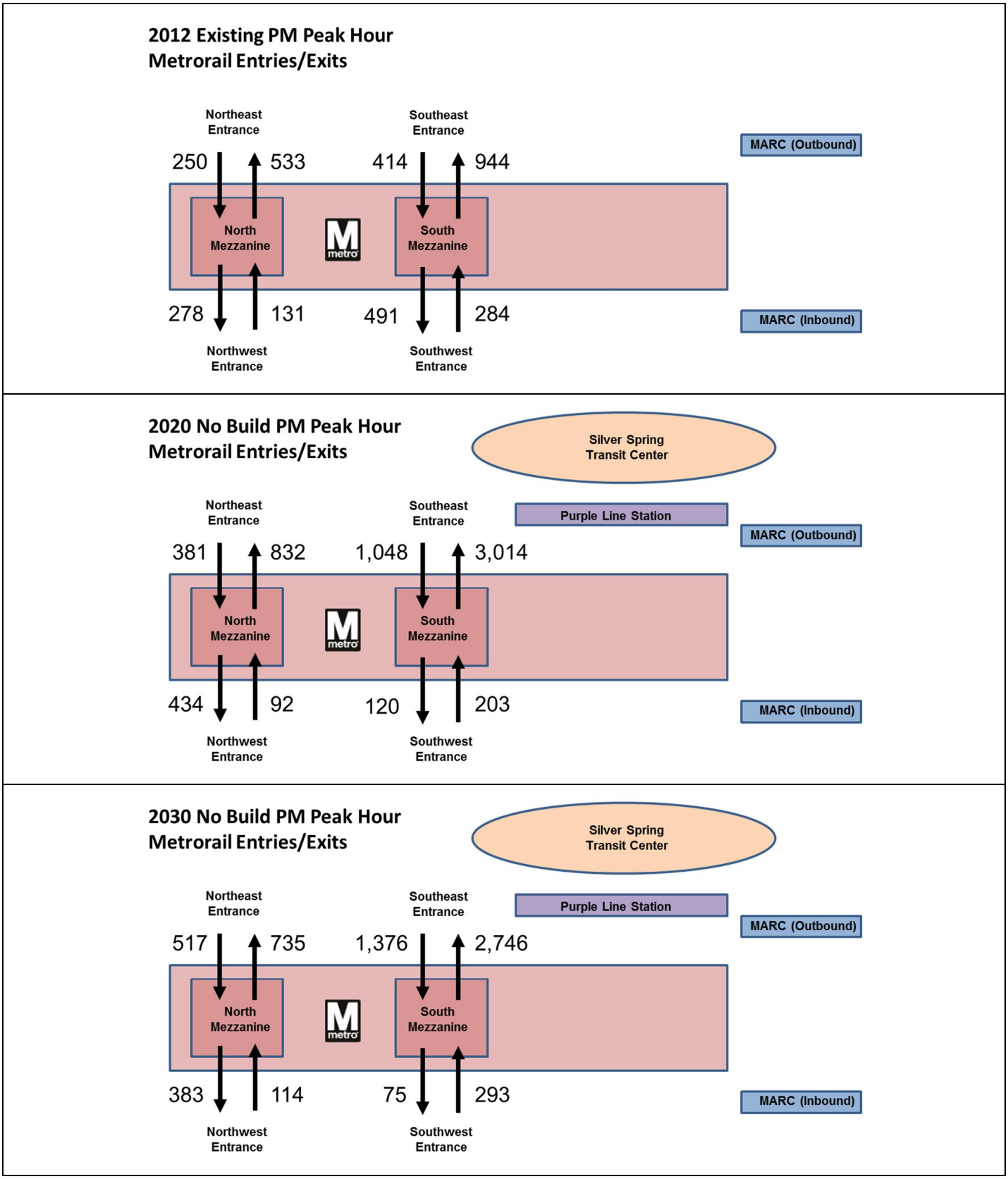


Figure 3-2: PM Peak Hour Metrorail Entries/Exits by Station Entrance



3.3 Future No Build Condition Pedestrian Model Simulations

This section reports the results of pedestrian model simulations of future No Build conditions (2020 and 2030) at Silver Spring Metrorail station. The simulation task investigated potential future station capacity constraints and related safety concerns for passenger circulation using travel demand forecasts and new pedestrian circulation patterns for transfers to and from the Purple Line station and Silver Spring Transit Center bus terminal. Detailed passenger flow matrices of pedestrian origin-destination (O-D) volumes in the station during the peak hour were prepared based on the demand forecasts. A simulation model of existing station conditions, based on current observations and 2012 ridership data, was developed to provide a baseline for comparison with the future year simulation results.

The simulations were conducted with Legion SpaceWorks software, modeling conditions during the AM and PM peak hours for the three time periods (2012, 2020 and 2030) based on the existing Metrorail station layout and the opening of the adjacent Silver Spring Transit Center and Purple Line stations by 2020. The No Build scenario does not include any changes within the existing Metrorail station or a direct connection to the Purple Line mezzanine level via a new Metrorail entrance. Quantitative measures of effectiveness (MOEs) were used to assess the performance of the station. The MOEs compare existing and future No Build conditions. The methodology and MOEs are described below.

3.3.1 Simulation Methodology

Model Limits

The red zones indicated on **Figure 3-3** through **Figure 3-5** below represent the extent of the Silver Spring Metrorail station models, which simulate pedestrian movements. The models include:

- Station street level entrance plazas
- Mezzanines and transfer areas
- Faregates
- Red Line inbound/outbound platform and trains
- Purple Line mezzanine (2020 and 2030 simulation models)
- MARC platforms
- Bus Transit Center level 1 and level 2 (2020 and 2030 simulation models)

Pedestrian Movements Modeled

Within the model limits, a few types of pedestrian movements are excluded or simplified. The models included Red Line trains for the purpose of simulating passenger boardings and alightings, but passenger circulation or density inside train cars were not assessed. The models include elevator structures in terms of the station layout and space open for pedestrian circulation but exclude elevator operations due to their relative modeling complexity and very marginal effect on overall pedestrian circulation patterns at the station.

For transfer services (MARC trains, Purple Line trains, and Transit Center buses), the models include aggregated boarding and alighting volumes based on scheduled headways. Each mode's passenger volumes are modeled to and from one or two simplified locations as follows:

- MARC – platform edge;
- Purple Line – mezzanine escalators and stairs leading up to the Purple Line platforms;
- Bus Transit Center level 1 (lower level) - threshold between the Metrorail station southeast entrance plaza and the east edge of the level 1 bus platform; and

- Bus Transit Center level 2 (middle level) – threshold between the interchange mezzanine and the east edge of the level 2 bus platform.

Figure 3-3: Extent of Silver Spring Station Model – Metrorail Mezzanine & Ground Level

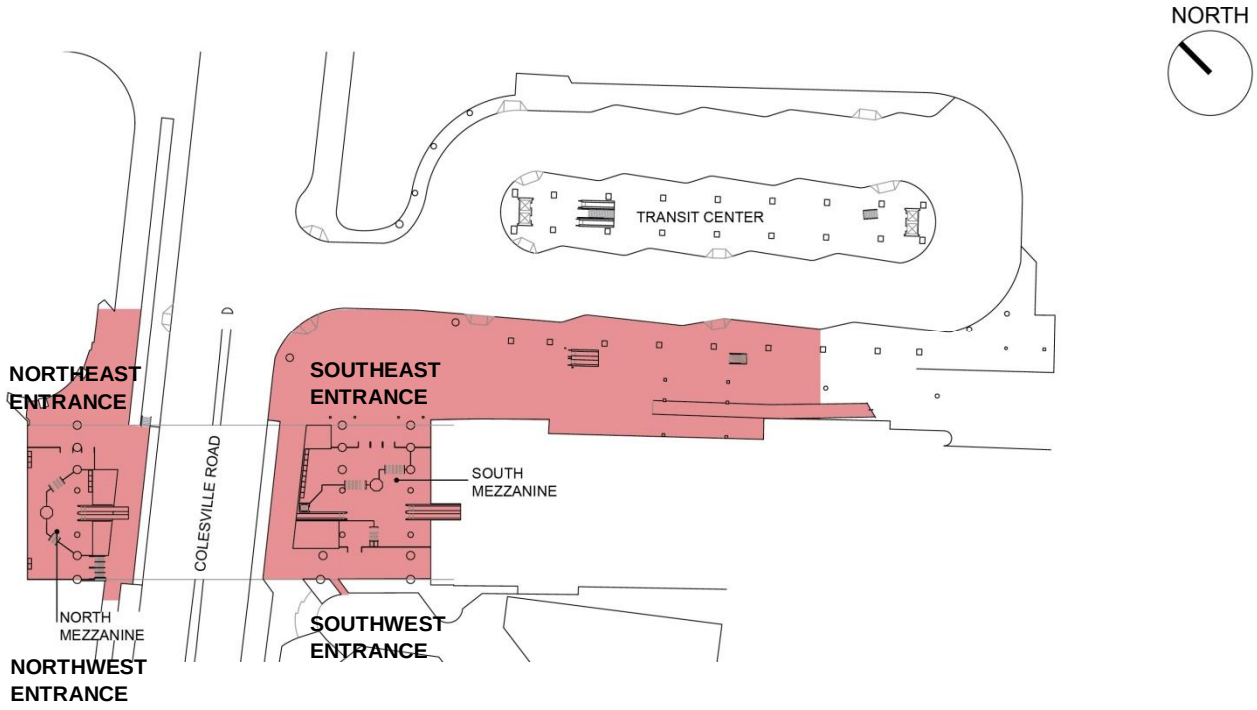


Figure 3-4: Extent of Silver Spring Station Model – Metrorail Platform Level & Transit Center Level 2

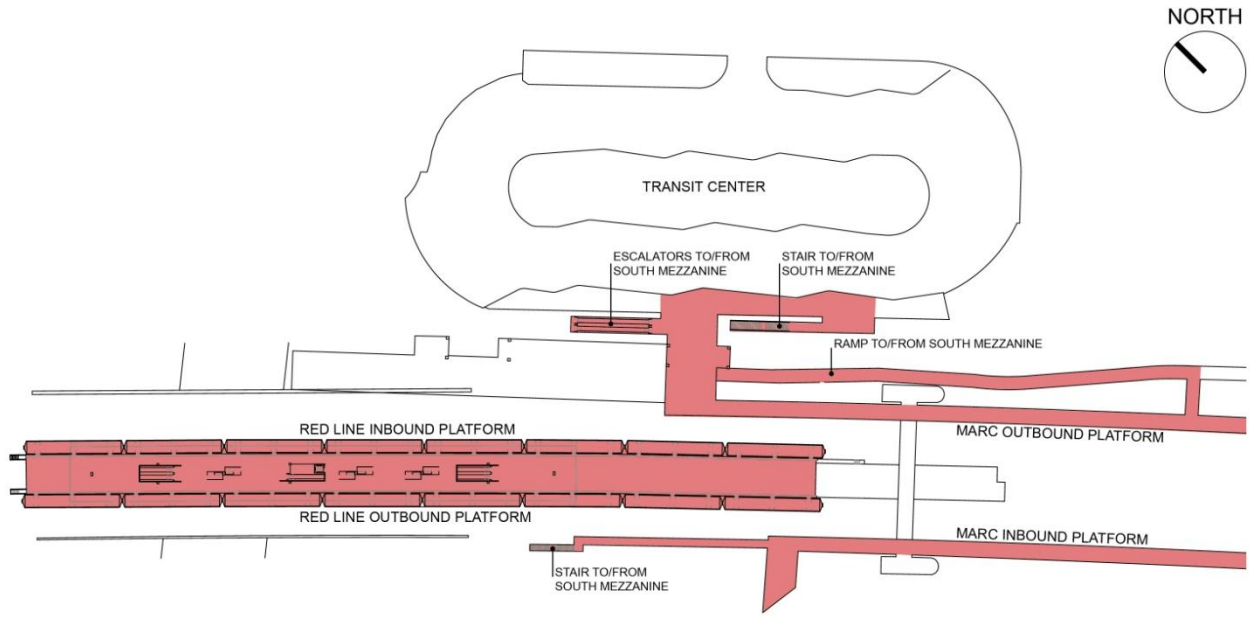
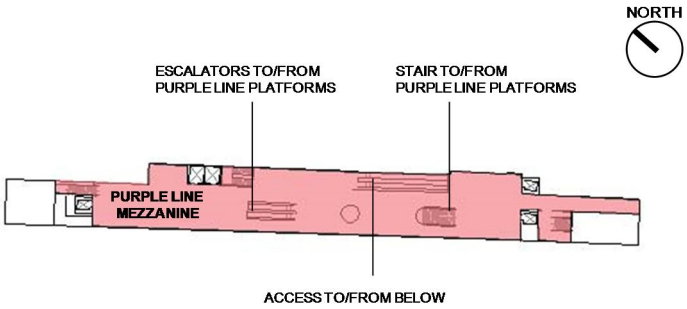


Figure 3-5: Extent of Silver Spring Station Model – Purple Line Mezzanine Level

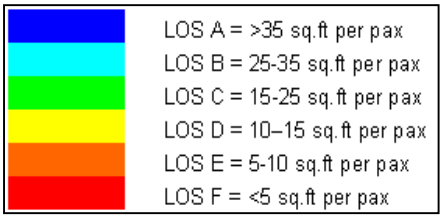


Note that the Purple Line mezzanine is located above the Metrorail platform level and Transit Center level 2, at the same level as Transit Center level 3.

Vertical circulation from the Purple Line Mezzanine to the ground level (Metrorail mezzanine level and Transit Center level 1) is provided by a single set of down escalators and a stairway. Initial model runs assumed that 100 percent of the down movement was assumed to use the escalator due to the considerable height difference (50 feet) from the Purple Line Mezzanine to Transit Center Level 1. However, significant congestion was observed in the initial model runs due to existing Purple Line passengers using the single down escalator. As a result, pedestrian movement at this level was revised, assuming that 25 percent of the down movement would switch to the stair (which goes all the way down to Transit Center Level 1, skipping Level 2) when the area by the escalators reaches pedestrian Level of Service (LOS) E.

3.3.2 Pedestrian Measures of Effectiveness (MOEs) Definitions

Mean Density



Passenger density is computed for each person by drawing a circular area (5'0" radius) around the passenger, estimating the accessible space inside that area, and then estimating the number of people inside that area including the person at the center of the radius. The passenger density is measured in square feet per person using Fruin's pedestrian walkway level of service (LOS) definitions (see chart on right), which rate pedestrian conditions from least crowded (LOS A) to most crowded (LOS F). Emphasis in the simulation analysis is given to the percentages of people in LOS E and F and the time LOS E and F are experienced. These densities are typically outside of the design maximum target of LOS D and can potentially result in unsafe conditions, particularly if they occur on platforms or at escalator and stair boarding areas.

Mean density maps, using the LOS color coding in the chart above, are used to depict station pedestrian conditions for key locations throughout the station during the peak 15-minute period. The maps focus on the platforms, mezzanines, circulation/transfer areas, and faregates. The peak 15-minute period, rather than the peak 1-hour period, is used for the density maps so that the specific points of acute crowding within the station are more apparent.

In addition, detailed passenger density analysis (described above) indicates the percentages of people within LOS E and F for each 15-minute period. The specific size of the analysis zones were established following the initial review of base models to ensure that the zones encapsulated only the most heavily used spaces. The analysis zones are consistent between current and future station layouts where the area's configuration is the same.

Vertical Circulation Operations

The busiest escalators and stairs were analyzed to determine the resulting queue properties; other escalators and stairs that were viewed to have no significant queuing during the peak hours were excluded from the detailed analysis. However, if a queue was present at a specific location in one or more scenarios, but not all scenarios, the location was included in the full analysis for all scenarios for comparative purposes. **Figure 3-6**, **Figure 3-7** and **Figure 3-8** show the locations of VCEs selected for the quantitative MOE analysis.

A zone was established at the area of each escalator and stair where boarding takes place. This zone measures the clearance time of each VCE every time a queue forms. People are deemed to be queuing when their walking speed is reduced to less than the escalator flow rate of 90 people per minute. Average clearance time (in seconds) of queues is the MOE used to assess vertical circulation operations.

Figure 3-6: Metrorail Mezzanine Level / Transit Center Level 1

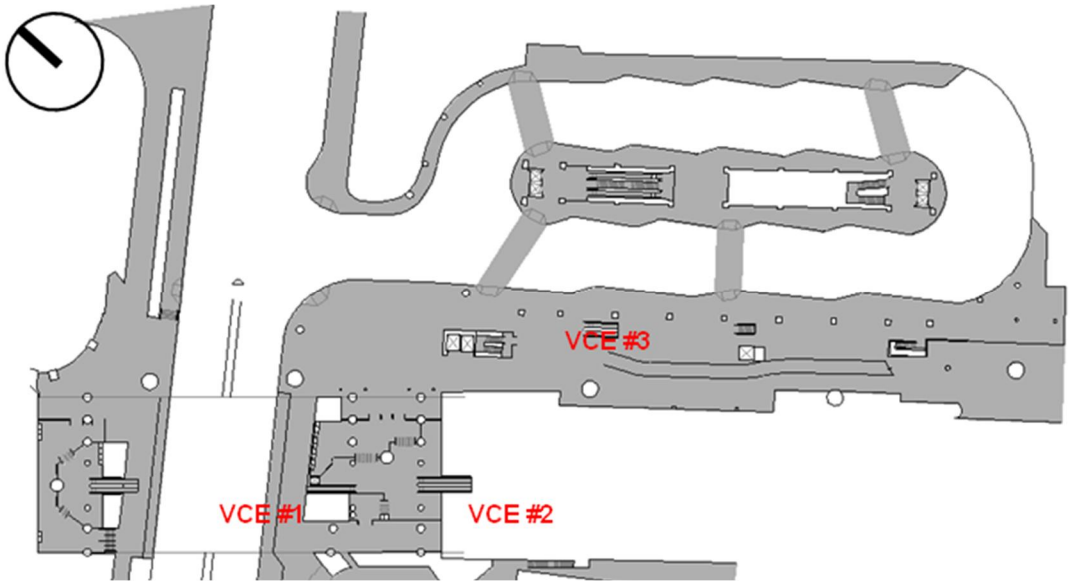


Figure 3-7: Metrorail Platform Level /Transit Center Level 2

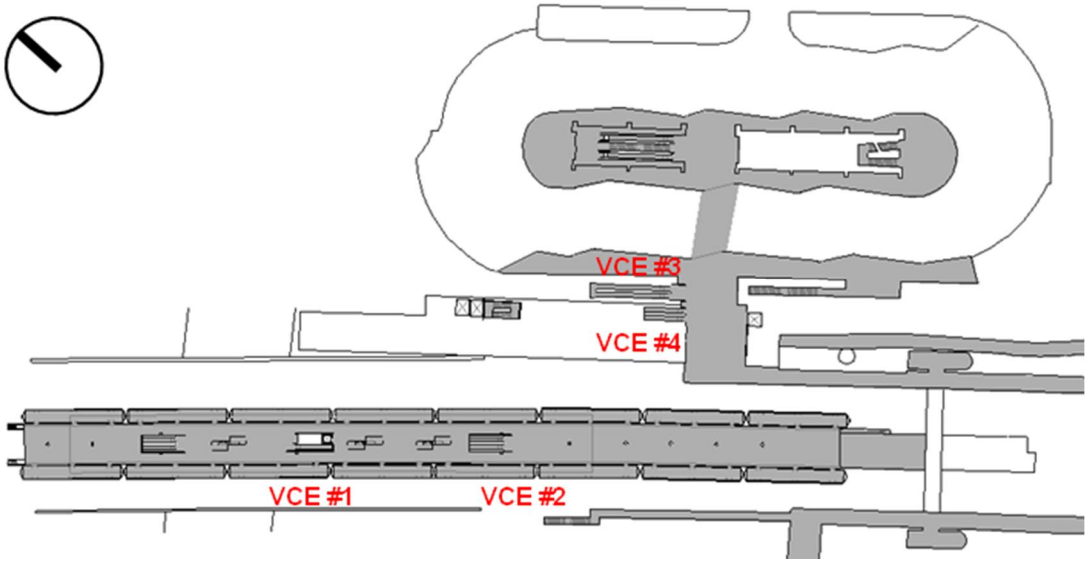
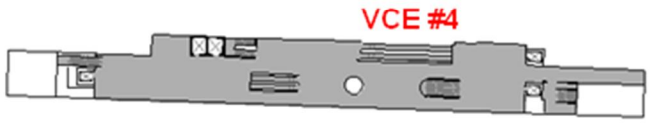


Figure 3-8: Purple Line Mezzanine Level



Journey Time

Journey time is the time (in seconds) taken by a person to complete his or her course through a model. The times are measured from the second a person enters the model to the second he reaches his or her destination within the station (e.g., train platform waiting area or station exit). The journey times for boarding passengers exclude platform waiting, and therefore represent only the circulation routes within the station rather than being skewed by train headway variability. The time for alighting passengers includes the platform walking time or platform congestion. Journey times are presented for the average time taken between each O-D pair.

Note:

- The random distribution of passengers from the passenger movement O-D matrices by the Legion SpaceWorks Software may result in small variations in journey times between similar O-D pairs that are statistically insignificant.
- For specific passenger O-D movements with small numbers of passengers in a peak period (<50), the small sample size leads to increased variability in results for modeled journey times; these O-D movements with small sample sizes are noted in the results.

Safety Analysis

It is not viable to provide a generic metric to assess the safety performance of a station, as there are typically four dynamic variables that need to be taken into account:

- Activity (waiting, walking, etc.)
- Context (mezzanines, vertical circulation elements, platforms, etc.)
- LOS (the percentages of people in crowded conditions, LOS E and F)
- Time (how long does the congestion last and what constitutes a long time?)

As a result of the dynamic nature of these variables, any specific areas of safety concern observed in the simulation videos and density maps are discussed on a case-by-case basis in the simulation findings.

Station Threshold Analysis

To prioritize capital improvements within the station and the entire Metrorail system, it is important to understand when Silver Spring Station will reach an overall passenger occupancy threshold. This threshold is defined as the year in which unsafe conditions could occur or that average LOS among key circulation areas reaches undesirable levels, measured as sustained densities above LOS D. The threshold is defined as 20 percent or more combined LOS E and F, measured by averaging the LOS of the station density analysis zones. Past experience in similar station contexts has shown these levels of service correlate to significant queues at VCEs or faregates and unsafe or disruptive levels of congestion on platforms and within other passenger circulation areas. Note that the individual analysis zone mean density results may reveal specific areas of acute crowding that should be addressed independent of the overall station threshold year.

In concert with the demand forecasting work, a qualitative analysis of the station reviewed the LOS of the zones identified in the density analysis and estimated the year that the overall station could reach capacity.

3.3.3 No Build Pedestrian Simulation Summary Findings

2020 No Build Condition Summary

During the PM peak, high volumes of passengers exiting to the southeast to transfer at the Transit Center and Purple Line cause substantial congestion on the Metrorail platform level at the queuing and boarding areas of the south mezzanine down escalators. Also, as a result of the higher volumes of passengers entering and exiting via the southeast entrance, minor congestion occurs at the southeast faregates during both the AM (ingress) and PM (egress) peaks.

On the Purple Line mezzanine level, a high volume of unloading Purple Line passengers with only a single escalator and single stair to Transit Center level 2 causes congestion at the down escalator during both AM and PM peaks. During the spikes of unloading Purple Line passengers, minor congestion occurs at Transit Center level 2 at the escalator down to the Metrorail mezzanine level/Transit Center level 1/ground level.

2030 No Build Condition Summary

By 2030, overall peak hour ridership is forecast to increase on the Purple Line but decline slightly on the Metrorail Red Line at Silver Spring. As a result of the relatively balanced overall demand, simulated conditions are similar between 2020 and 2030.

3.3.4 No Build Pedestrian Simulation Detailed MOE Results

Detailed results comparing existing and future No Build conditions are described in the sections below for passenger density, vertical circulation operations, and journey time.

Comparison of Existing and Future No Build Pedestrian Density

Passenger density maps were established for the peak 15-minute periods. Areas of orange and red denote LOS E and F, respectively. The typical design target for platforms, transfer areas, and mezzanines is LOS C (green), with a not-to-exceed maximum guideline of LOS D (yellow). **Figure 3-9** through **Figure 3-14** show the mean density maps for the AM and PM peak 15-minutes. These figures use the scale shown to the right for Level of Service.

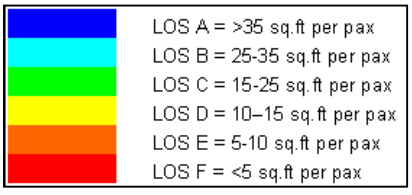
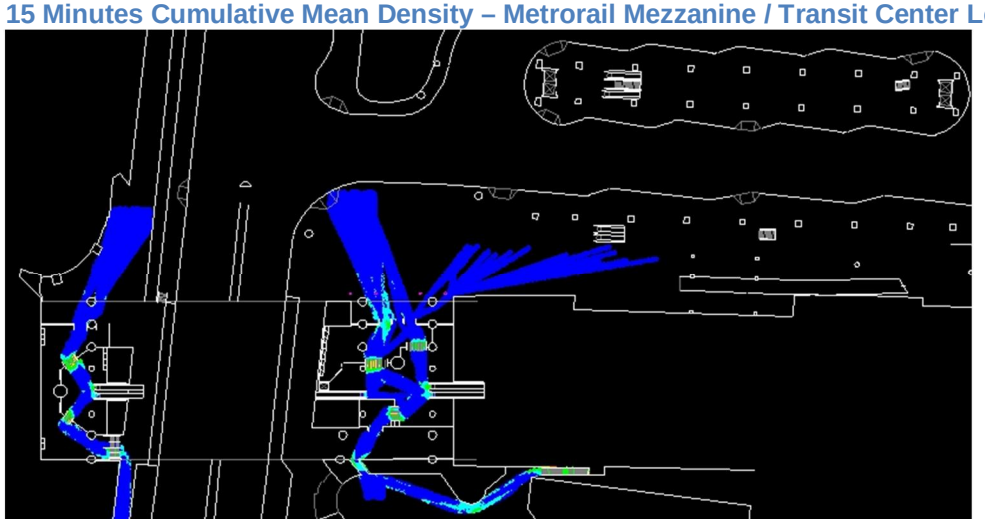


Figure 3-9: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine / Transit Center Level 1

Existing 2012



No Build 2020

No Build 2030

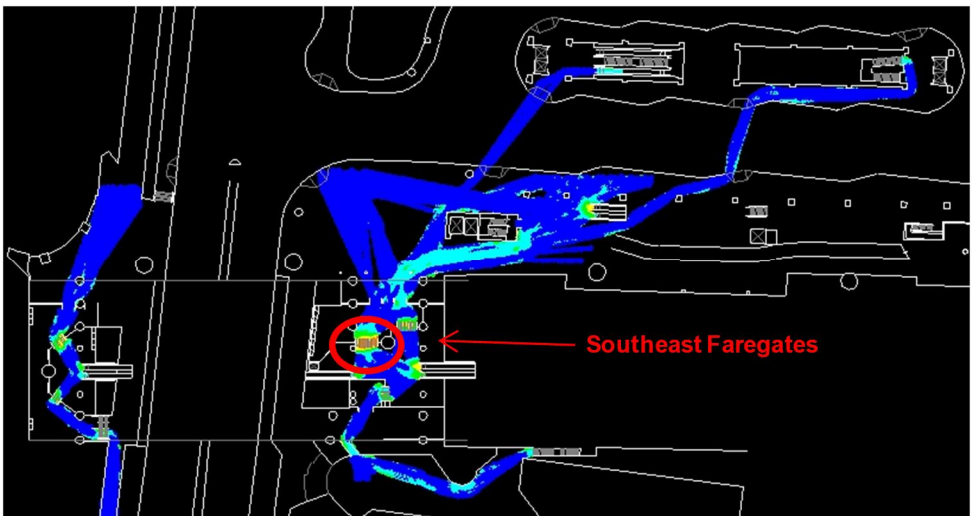
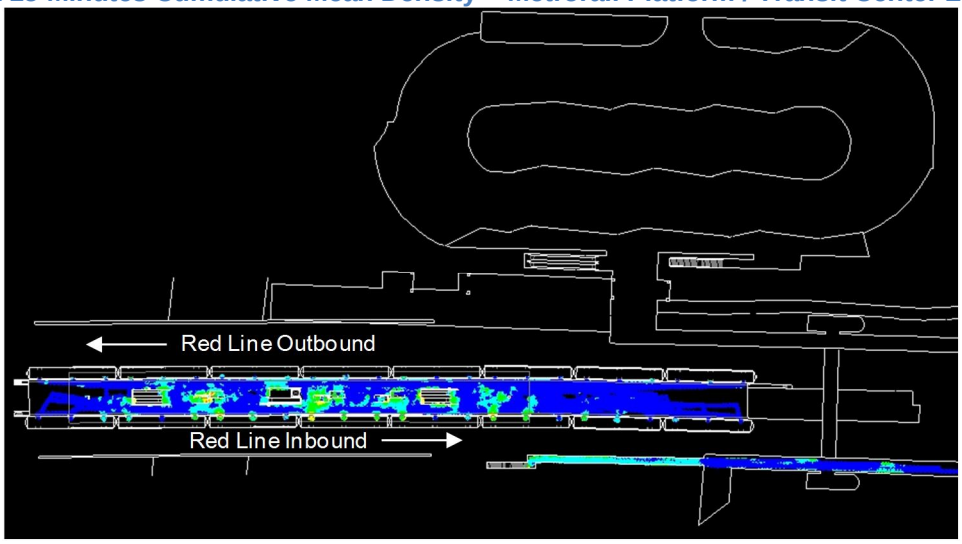
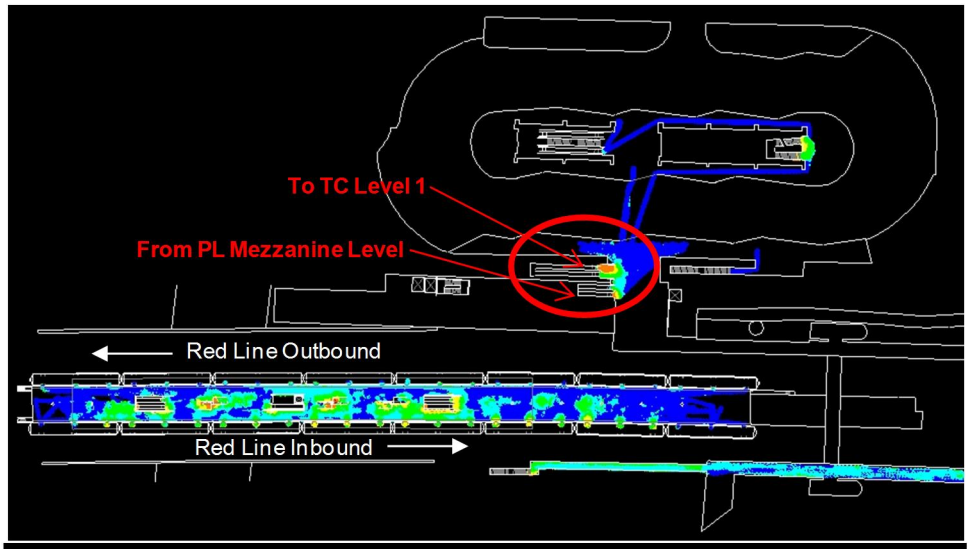


Figure 3-10: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform / Transit Center Level 2

Existing 2012



No Build 2020



No Build 2030

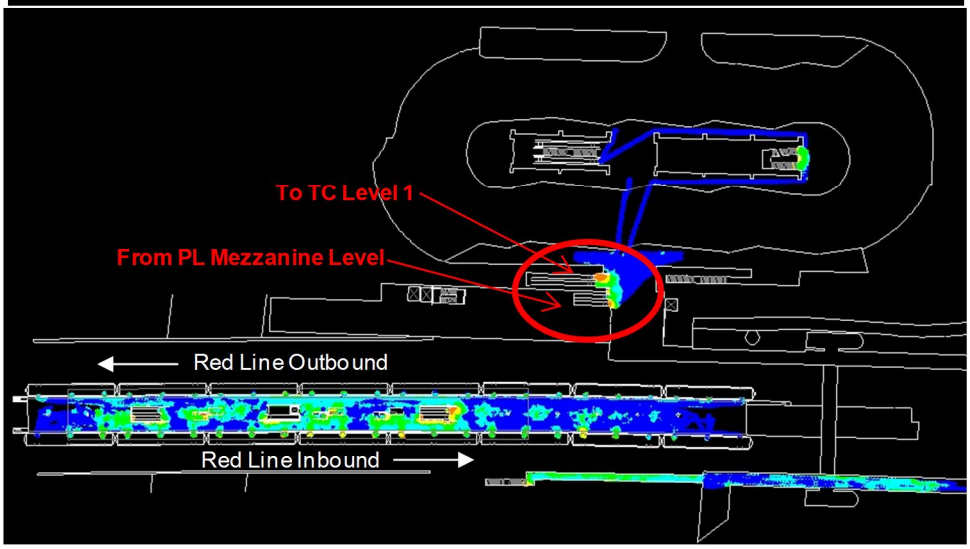
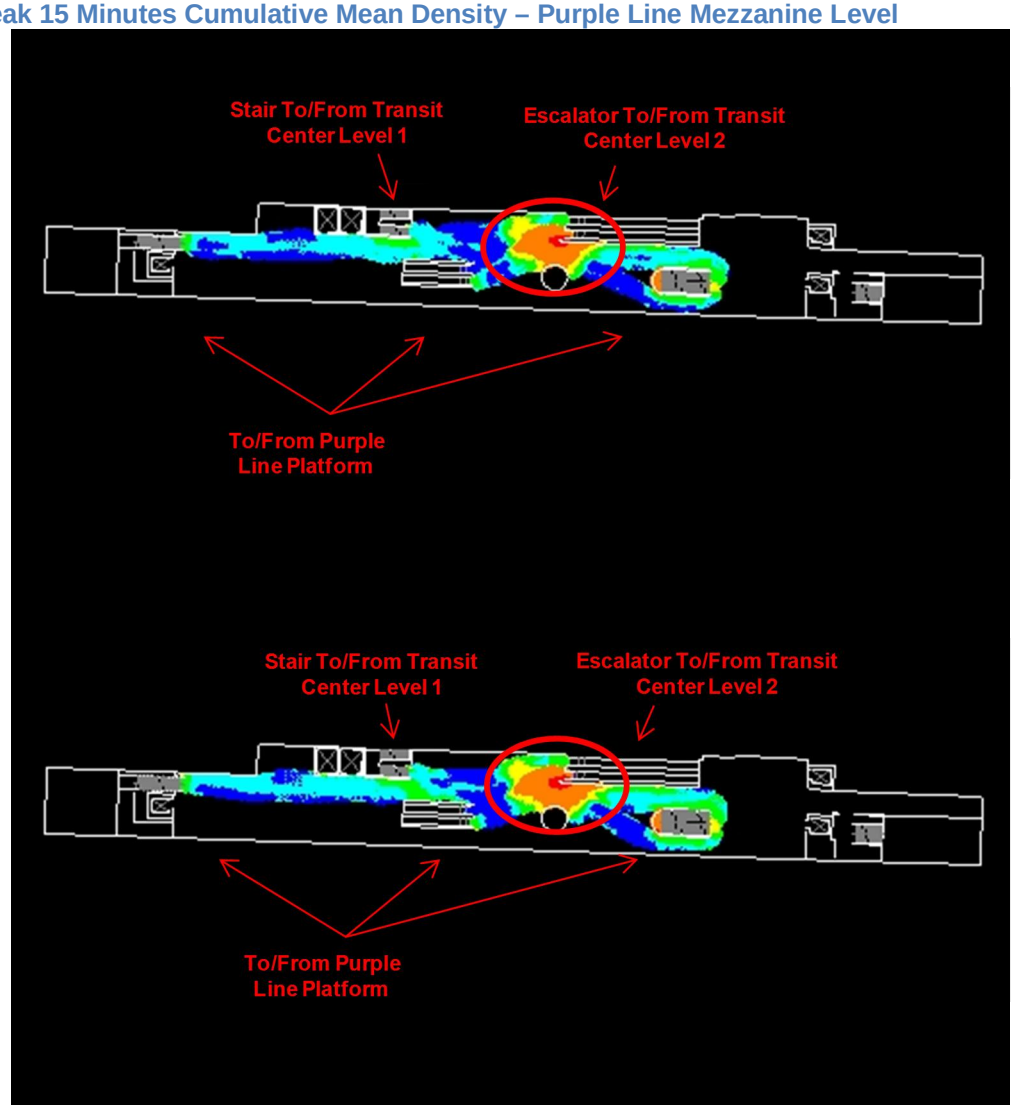


Figure 3-11: AM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level

No Build 2020



No Build 2030

Figure 3-12: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine / Transit Center Level 1

Existing 2012

No Build 2020

No Build 2030

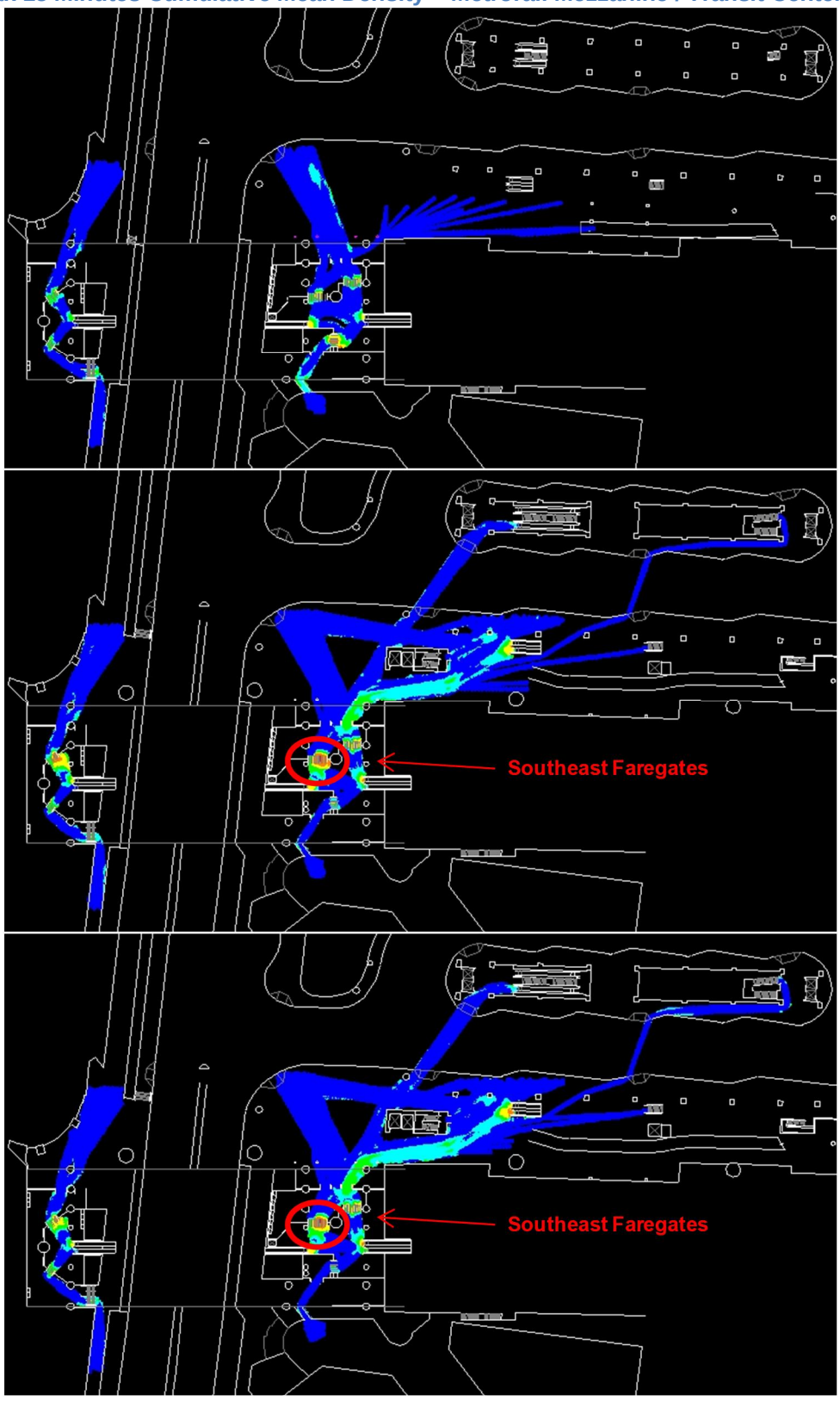
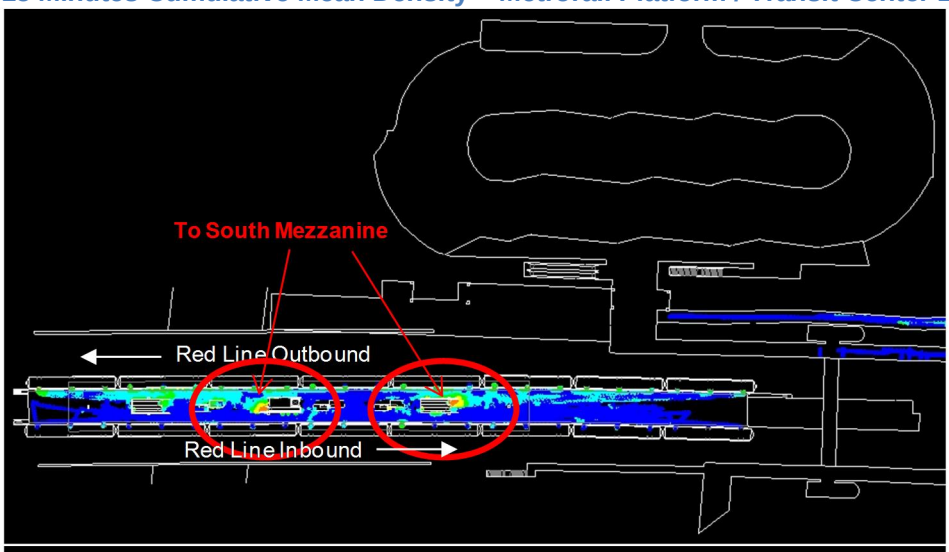
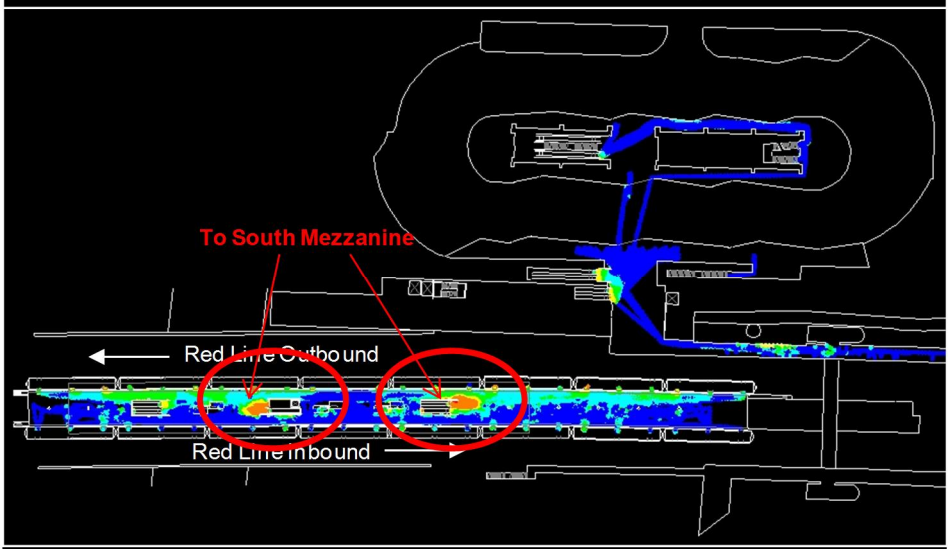


Figure 3-13: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform / Transit Center Level 2

Existing 2012



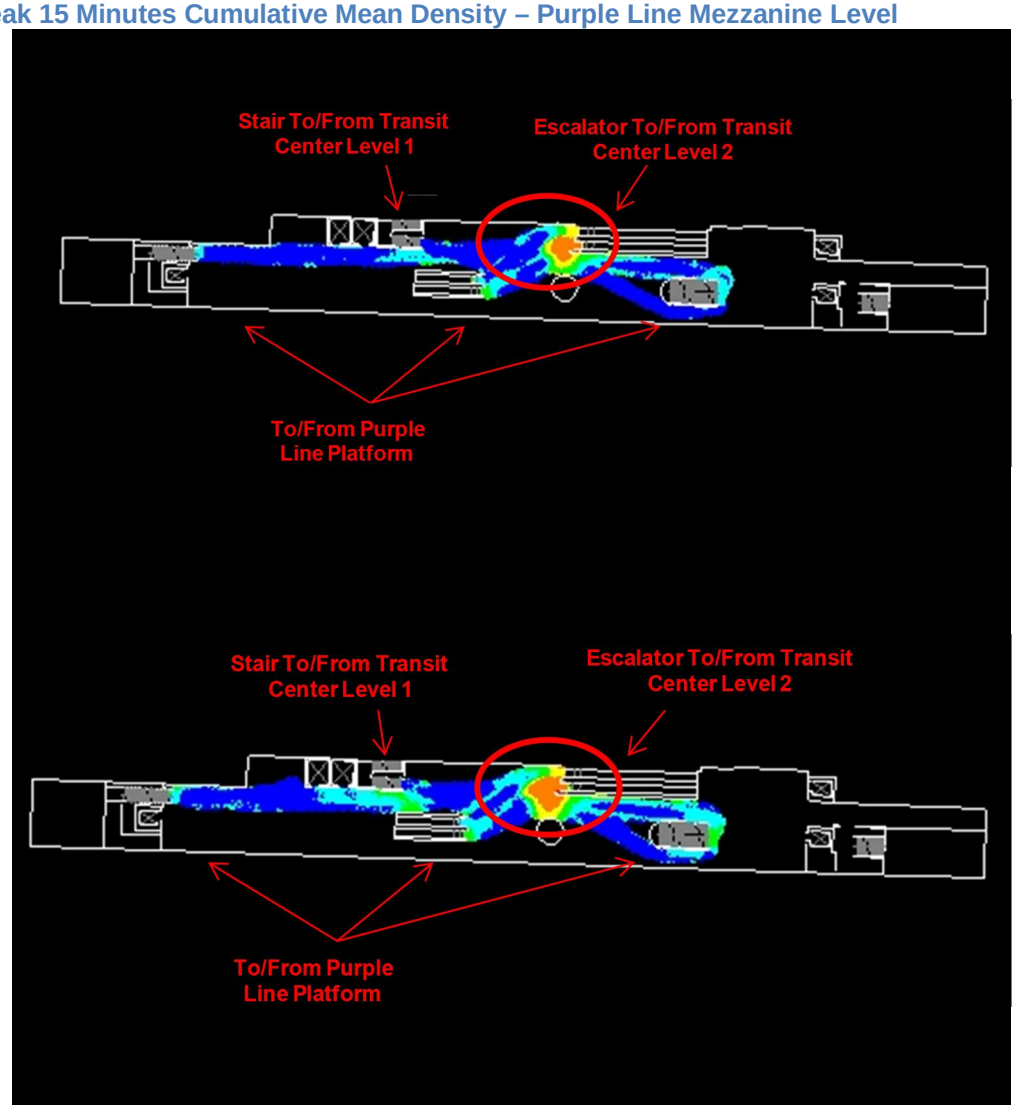
No Build 2020



No Build 2030

Figure 3-14: PM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level

No Build 2020



No Build 2030

As shown in **Table 3-8**, the highest densities (combined LOS E and F over 20 percent) are recorded on the Purple Line mezzanine during the AM peak hour in 2020 and during the AM and PM peak hours in 2030. These high densities occur due to the high volume of unloading Purple Line passengers with only a single escalator and single stair to Transit Center level 2.

Table 3-8: AM and PM Peak Hour Zone Density Comparison (LOS E and F)

Analysis Zone		2012 Existing Condition		2020 No Build		2030 No Build	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Zone A Metrorail Platform	% LOS E	1	2	3	13	3	9
	% LOS F	0	0	0	2	0	1
	Combined % LOS E & F	1	2	3	15	3	10
Zone B Purple Line Mezzanine	% LOS E	-	-	**40**	12	**42**	17
	% LOS F	-	-	16	1	15	5
	Combined % LOS E & F	-	-	**56**	13	**57**	**22**

Note: Transit Center and Purple Line not in operation in 2012.

Station Threshold Analysis

As shown in **Table 3-9**, in the 2020 opening year of the Purple Line, the passenger density analysis zones reach an average density (combined AM and PM peak hours) above the defined desired maximum threshold of 20 percent of passengers experiencing LOS E and F. The high densities above 20 percent are limited to the Purple Line mezzanine, as shown in **Table 3-8** above. Although not in the Metrorail station itself, pedestrian congestion on the Purple Line mezzanine level and vertical circulation elements in the Transit Center would adversely affect a significant share of Metrorail users including:

- Red Line passengers who transfer to/from the Purple Line;
- Bus lines passengers on the Transit Center level 2; and
- MARC passengers.

These transfer passengers will use the Transit Center escalators and stairs and the Purple Line circulation areas, and would be impacted by congestion through longer journey times and more crowded conditions while transferring to and from Metrorail. Congestion of Transit Center VCEs would also adversely affect some bus users (not transferring to and from the Purple Line or Metrorail) who board buses on the middle level or who must make bus-to-bus transfers between levels.

Table 3-9: Combined Peak Hours and Zones Average Density Comparison (LOS E and F)

	Average % LOS E & LOS F		
	2012 No Build	2020 No Build	2030 No Build
Zones A and B Combined	2	**22**	**23**

Note: Only Zone B has combined percent LOS E and F above 20 percent.

Comparison of Existing and Future No Build Escalator Queues

The busiest VCEs were analyzed to determine the resulting queue properties. VCEs that were viewed to have no significant queuing during the peak hours were excluded from the detailed analysis (see **Figure 3-6, Figure 3-7, and**

Figure 3-8 for VCE nomenclature). **Table 3-10** lists the average VCE queue clearance times (recorded in minutes, seconds) derived from the simulations.

Table 3-10: Vertical Circulation Peak 15 Minutes Average Clearance Times (Minutes:Seconds)

Vertical Circulation Elements		2012 Existing Condition		2020 No Build		2030 No Build	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Between Metrorail Platform and South Mezzanine	VCE 1 (Down)	(up operation)	**0:11**	(up operation)	**0:49**	(up operation)	**0:49**
	VCE 2 (Down)	No queue	**0:11**	No queue	**1:11**	**0:43**	**0:58**
Between Transit Center Level 2 and Transit Center Level 1	VCE 3 (Down)	-	-	**1:19**	No queue	**1:15**	No queue
Between Purple Line Mezzanine and Transit Center Level 2	VCE 4 (Down)	-	-	**1:58**	**0:45**	**2:13**	**1:02**

Note: Transit Center and Purple Line not in operation in 2012.

The down escalator from the Purple Line Mezzanine to Transit Center Level 2 (VCE 4) is the most heavily used escalator during both the AM and PM peaks as a result of the high volume of unloading passengers from the Purple Line, though none of the escalator queues last longer than three minutes in average clearance time for any scenario.

Journey Time

Overall station journey times averaged between AM and PM peak hours do not increase significantly. The following movements have notable changes in journey time between 2012 and 2020:

- In the PM peak, increases in Red Line egress journey times occur for all four station exits (ranging from 8- to 17-second increases, depending on the exit);
- In the AM peak, only Red Line egress to the northwest exit experiences a significant increase (18 seconds); and
- PM peak hour journey time for Red Line transfers to MARC decrease due to the shorter pedestrian route enabled by the Transit Center connection to the outbound MARC platform.

Between 2020 and 2030, journey times generally do not change significantly. Journey times between the Purple Line Mezzanine and Metrorail platforms without a direct mezzanine connection are approximately three and a half minutes.[3]

Safety Analysis

None of the areas of crowding or queuing observed in the future No Build simulations occurs in areas that present immediate safety concerns, such as along a platform edge. Although some limited areas of LOS E and F appear, none are along a platform edge, adjacent to a vehicle driveway, or within a restricted space.

[3] Note that, as the pedestrian simulations did not model the Purple Line platform level, the Purple Line journey times in all scenarios are measured to/from the escalators between the Purple Line Mezzanine Level and the Purple Line platform level and do not include walking time on the Purple Line platform between train cars and escalators and queuing for the escalators down to the Purple Line Mezzanine Level.

4.0 Station Improvement Concepts

The study developed and evaluated concept design alternatives to address future passenger circulation needs at the Metrorail station, which include:

- Overall ridership increase due to forecast station area land use changes;
- New circulation patterns related to the adjacent Transit Center under construction;
- Passenger transfers associated with the new Purple Line planned to open in 2020; and
- Improved ADA access, particularly at the north mezzanine.

Table 4-1 lists the initial design alternatives explored and fully developed concepts advanced for evaluation.

Table 4-1: Station Improvement Concepts and Design Process

Concept	Issues Addressed	Alternatives Developed	Modeling/Evaluation
North Mezzanine New Elevator	Improved ADA access and faregate capacity	Initial design options; **Single fully developed design concept**	**Included in pedestrian model simulation build alternatives (below); Summary evaluation**
Purple Line-Metrorail Mezzanine Connection	Purple Line transfers; Transit Center transfers; Overall ridership increase; ADA access to/from southeast of station	Initial alternatives (A through D)	(*not carried further for detailed analysis*)
		Alternative E	**Pedestrian simulation build alternative; Summary evaluation**
		MARC Pedestrian Bridge Connection (Alternative F)	(*not carried further for detailed analysis*)
		Wider mezzanine initial alternatives (G and H, Options A-C)	(*not carried further for detailed analysis*)
		Alternative H (Option D)	**Pedestrian simulation build alternative; final Summary evaluation**

Note: Alternatives fully developed for detailed modeling and evaluation shown in **bold**

This section describes the improvement concepts that were developed, summarizes the pedestrian model simulations of the alternatives selected, provides conceptual cost estimates, and evaluates the alternative concepts.

4.1 Design Considerations

Under modeled future No Build conditions in 2020 and 2030, the shift in passengers to the Metrorail station's south mezzanine for all bus transfers and the addition of Purple Line transfers at the south mezzanine will significantly increase mezzanine faregate and VCE queues and platform crowding near the VCEs to the south mezzanine. As a result, low cost alternatives to expand vertical circulation capacity to and from the south mezzanine are not feasible due to station space constraints – the station's center platform layout and adjacent CSXT tracks limit the available space for connections between the mezzanine and platform levels. Furthermore, expanding the south mezzanine by itself would not shorten the transfer time between the Purple Line platform and the Metrorail platform. Thus, the design task focused on the development of concepts for the Purple Line-Metrorail mezzanine connection as a means to address future station capacity deficiencies and enhance intermodal transfers.

The North Mezzanine New Elevator concept was developed separately as an independent improvement concept and could be implemented as a stand-alone station improvement. If any other major capital improvements to the Metrorail

station are planned, such as the Purple Line-Metrorail Mezzanine Connection, then the North Mezzanine New Elevator would be incorporated among the package of improvements, based on WMATA's general policy to address ADA access improvements during major facility overhauls.

4.2 North Mezzanine New Elevator

The study developed a concept design for an elevator connecting the north mezzanine to the platform. Currently only a single elevator, located at the south mezzanine provides elevator access to and from the platform level. The purpose of the proposed improvement is to expand ADA access at the station, serving passengers at the north mezzanine and providing redundancy for situations when the south mezzanine elevator is out of service.

Platform Level

The proposed new elevator is located just north of the existing platform canopy and would displace a single existing sign pylon/lamppost. The new platform elevator needs to be located in the center of the Metrorail platform to allow passenger circulation on both sides.

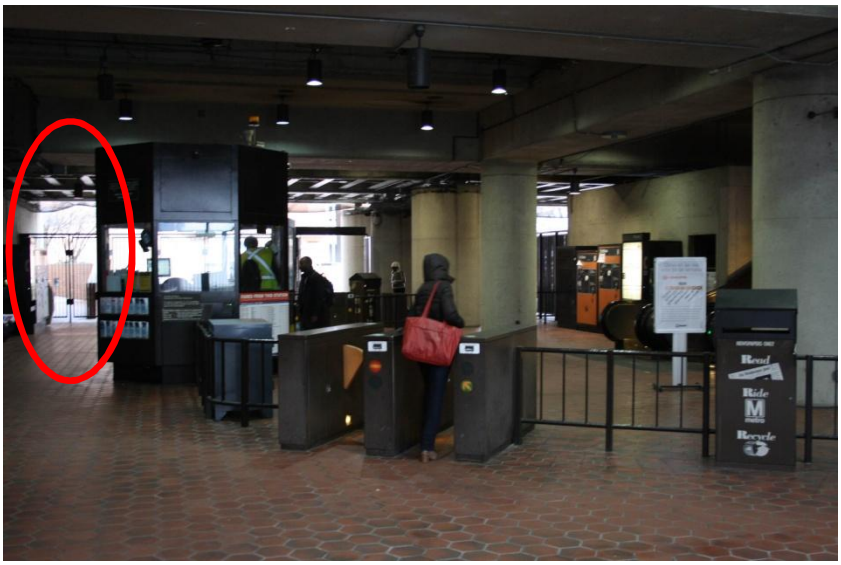
North end of Metrorail platform; location proposed for new elevator

Mezzanine Level

The new elevator would need to be along the central axis of the mezzanine and located out of the main pedestrian circulation area inside the faregates. This location requires the station manager's kiosk to be shifted to the side and also separates the "free" areas outside the faregates for the northeast and northwest entrances.

The enclosed mezzanine area would be expanded to the east to accommodate the shifted northeast entrance faregates, station manager kiosk, and queuing area. In addition the reconfigured mezzanine level would include:

- New Metro staff break room to serve the north mezzanine;
- Exitfare machines for the northwest entrance to the mezzanine; and
- Additional faregates at each entrance to the north mezzanine to provide redundancy and meet Metro standards (see **Table 4-2** on the following page).



North Mezzanine; location proposed for new elevator

Table 4-2: North Mezzanine Faregate Capacity

North Mezzanine	Current Faregates		Proposed Faregates with Mezzanine Reconfiguration	
	Standard	ADA	Standard	ADA
Northeast Entrance	2	1	4	1
Northwest Entrance	2	0	3	0*

* Northwest entrance is not ADA accessible and is located a short-distance from the northeast entrance, so no ADA gate is proposed

Figure 4-1 on the following page shows the existing north mezzanine and reconfigured north mezzanine with the new elevator. **Appendix A** includes the complete set of concept drawings.

4.3 Purple Line-Metrorail Mezzanine Connection

MTA has included space for a mezzanine connection (to be built by others) between the Purple Line mezzanine level and the south end of the Metrorail platform to accommodate transfers. Concept design alternatives for the Purple Line-Metrorail mezzanine were developed based on the location identified in Purple Line station drawings. A series of alternatives were explored (Alternative A through Alternative H), including minor design options for several of the alternatives. Two of the alternatives (Alternative E and Alternative H (Option D)) were selected for pedestrian simulation modeling and evaluation. MTA Purple Line project team representatives were engaged throughout the study process in reviewing and providing feedback on the alternatives developed.

The connection developed in the current study includes the following elements:

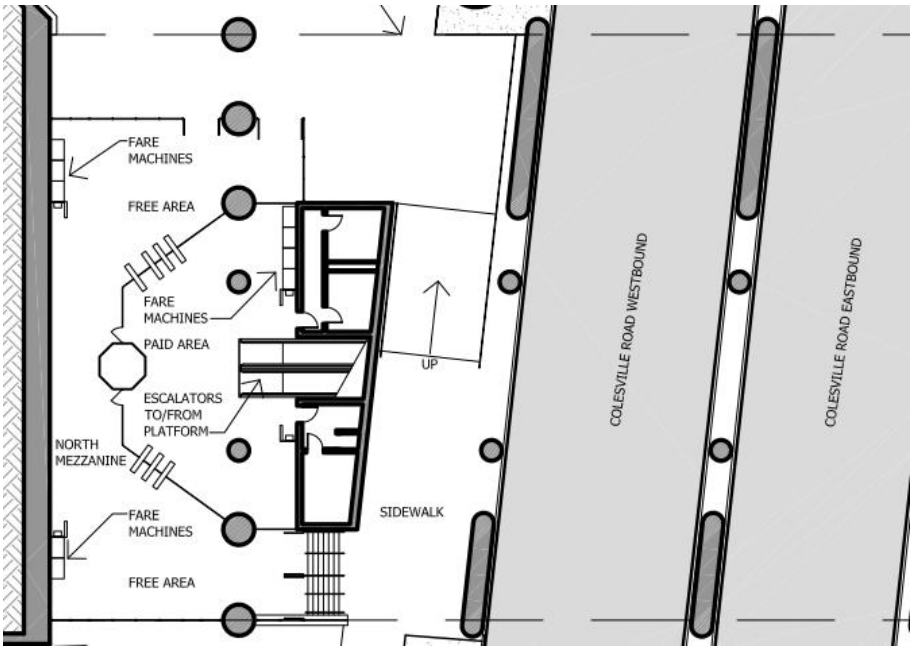
- Mezzanine bridge extending from the Purple Line mezzanine level across the northbound CSXT and Metrorail tracks;
- New Metrorail station entrance with faregates, station manager kiosk, and fare vending machines;
- VCEs from the new Metrorail entrance mezzanine to the Metrorail platform;
- Support columns on the platform for the new mezzanine; and
- Escalator canopy from the mezzanine to the platform level that connects with the existing platform canopy (note that this connection and dovetail of architectural designs would need further design outside the scope of this project).

The landing location would potentially affect four existing pylon signs/lampposts. Part of this area on the platform (in red in photo below and on following page) under the mezzanine connection would remain open to pedestrian circulation; only the escalator/stair landings and support columns would take up platform area.

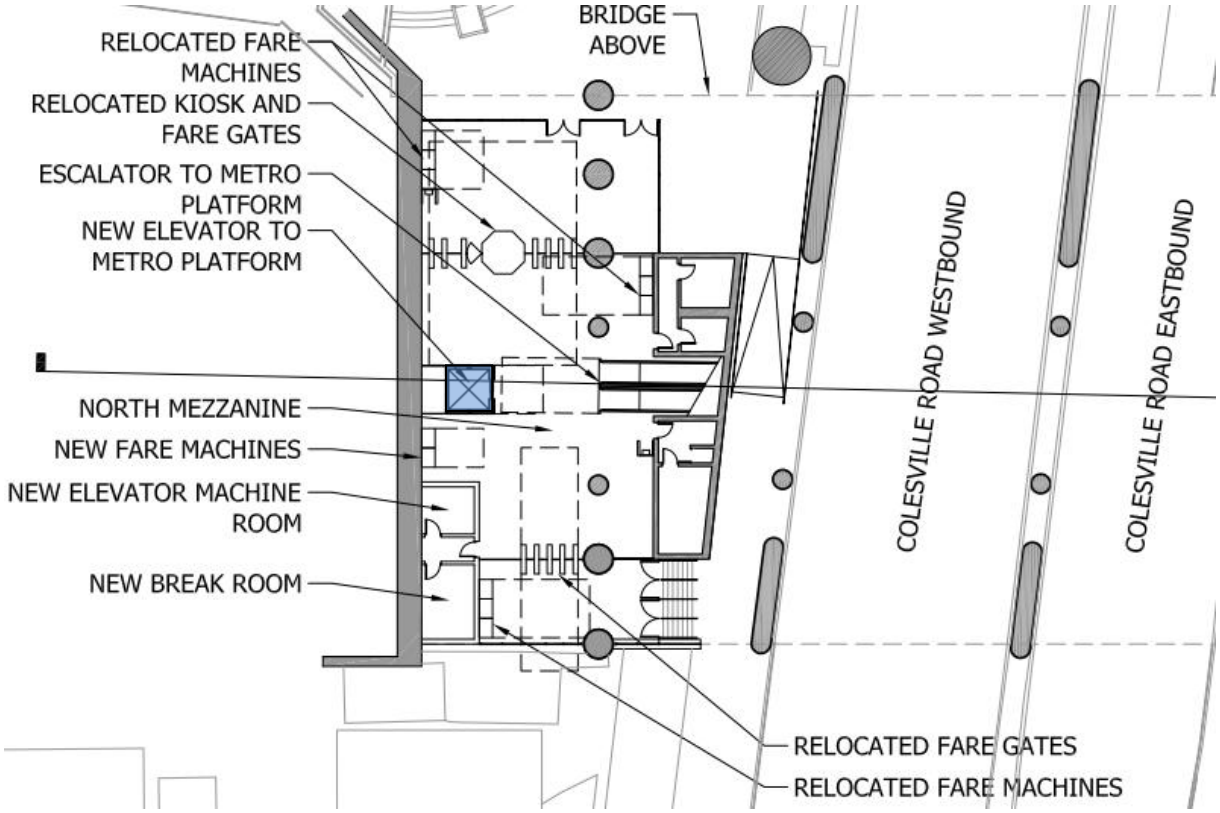
South end of Metrorail platform; general location proposed for Purple Line-Metrorail Mezzanine Connection

Figure 4-1: Existing North Mezzanine and Reconfigured North Mezzanine with New Elevator

EXISTING NORTH MEZZANINE LAYOUT



RECONFIGURED NORTH MEZZANINE LAYOUT WITH NEW ELEVATOR



4.3.1 Development of Initial Alternatives

Initial concept designs (Alternatives A through D, not carried further) for the Purple Line-Metrorail Mezzanine Connection developed alternatives that expanded the facility vertical circulation capacity from previous concept sketches by adding:

- Two sets of escalators or escalator/stair banks; and
- Two mezzanine-to-platform elevators to provide redundancy.

To provide sufficient space for the vertical circulation elements, a design was developed that placed the elevators side-by-side across the width of the platform. Because the space between the elevators and platform edge would not be wide enough for passenger circulation, the design placed the elevators within a portion of the existing service rooms at the end of the platform.

South end of Metrorail platform, general location proposed for landing of Purple Line-Metrorail Mezzanine Connection; existing train control facility and service rooms are visible at end of platform

This portion of the service rooms is currently used as a train control facility associated with the current Metrorail Red Line operations that turn back half of the trains at Silver Spring station (rather than at Glenmont); by 2030, all Red Line trains will terminate at Glenmont. These design elements were incorporated in subsequent alternatives described on the following pages that were further refined for pedestrian model simulation and evaluation.

4.3.2 Alternative E (fully developed for pedestrian model simulation and evaluation)

The concept design was fully developed for pedestrian model simulation, cost estimation, and evaluation (see **Figure 4-2** and **Figure 4-3**). The design incorporates the following elements:

- Escalator pair and an escalator-stair pair;
- Two-elevator arrangement that uses the service rooms at the south end of the platform to reduce cost and increase safety on the platform during construction;
- Diagonal (“canting”) bridge connection from the Purple Line mezzanine to the new WMATA mezzanine; and
- Faregate capacity of six (6) standard faregates and one (1) ADA faregate.

Figure 4-2: Purple Line-Metrorail Mezzanine Connection Alternative E (Plans)

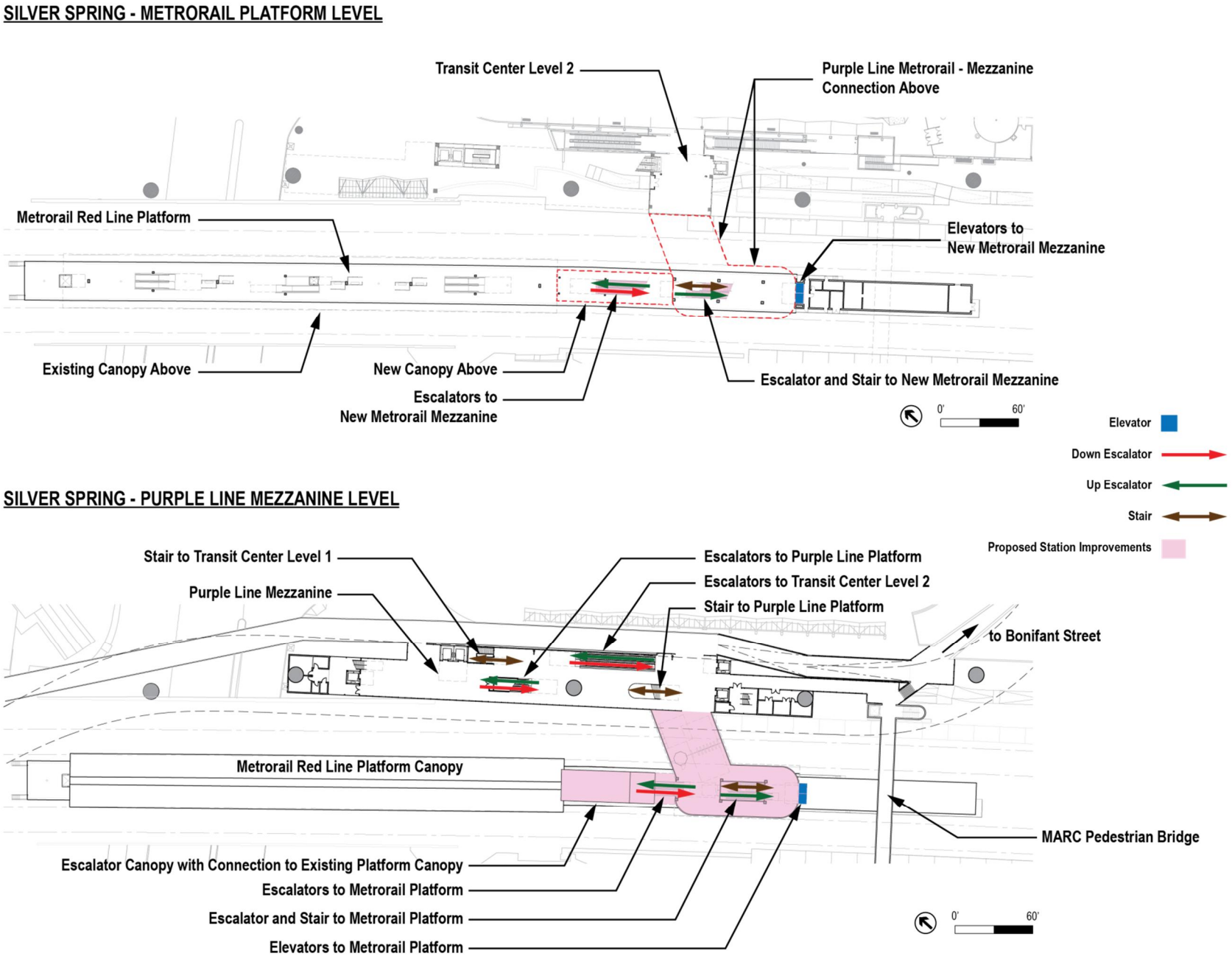
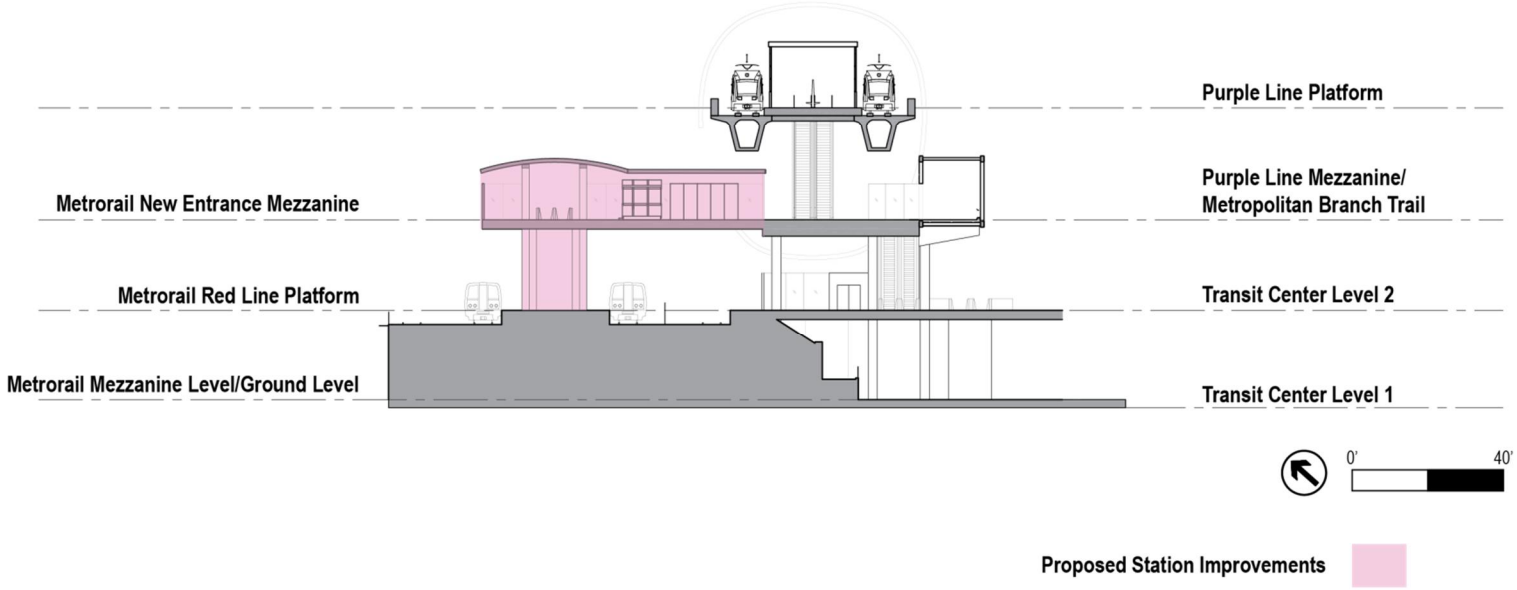
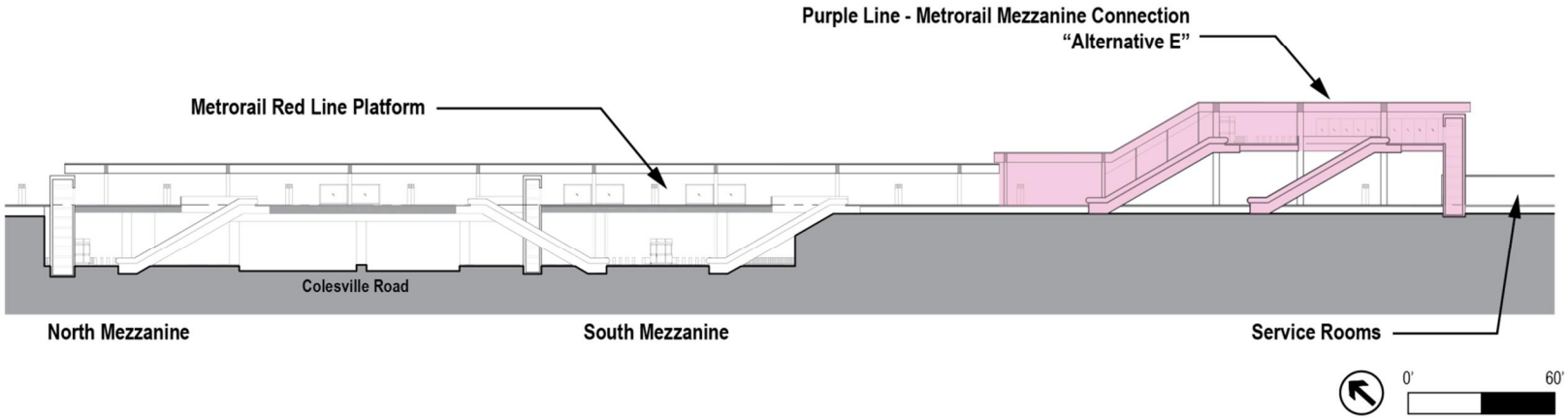


Figure 4-3: Purple Line-Metrorail Mezzanine Connection Alternative E (Sections)

CROSS SECTION



LONGITUDNAL SECTION OF METRORAIL PLATFORM



4.3.3 Alternative F (MARC pedestrian bridge connection – not carried further)

An alternative mezzanine design that builds on Alternative E by adding a second entrance via the existing MARC pedestrian bridge was developed. The alternative was developed to explore expanded access to the new Metrorail entrance in addition to access via the Purple Line mezzanine. However, the second entrance would not likely attract significant numbers of users given the limited access to the existing MARC pedestrian bridge. In addition, modifying the existing MARC pedestrian bridge structure to accommodate an opening into the new Metrorail mezzanine at the mid-point of the bridge would present various engineering challenges, possibly requiring construction of a new pedestrian bridge. Thus, Alternative F was not carried further for pedestrian model simulation.

4.3.4 Alternative H (Option D) (fully developed for pedestrian model simulation and evaluation)

To expand faregate capacity at the new Metrorail entrance to accommodate the higher than initially anticipated demand, additional rough concepts (Alternatives G and H (Options A-C)) for the Purple Line-Metrorail Mezzanine Connection were developed, leading to the final Alternative H (Option D) that was fully developed. These concepts developed wider mezzanine bridges. Vertical circulation capacity to the platform is the same as Alternative E.

A spreadsheet analysis of faregate capacity needs[4] at the new Metrorail entrance based on 2030 travel demand forecasts and station O-D matrices showed that the new entrance should have seven standard faregates and one ADA faregate. To be able to accommodate potential additional ridership growth and use of the new Metrorail mezzanine beyond 2030, space for one additional faregate was incorporated.

The final preferred option, Alternative H (Option D) (see **Figure 4-4** and **Figure 4-5**), also incorporates the following:

- Center kiosk faregate array design per WMATA architectural recommendations;
- Additional space for queuing areas of fare vending machines and faregates; and
- Longer mezzanine area to accommodate the wider and perpendicular bridge connection, providing additional pedestrian circulation space.

Appendix B includes the complete set of concept drawings.

[4] Faregate spreadsheet capacity analysis is based on 35 passengers per minute faregate throughput for passenger entries and exits within half a train headway during the peak 15-minutes in the AM and PM peak hours per WMATA guidelines. Total faregates needed equals the base number of standard faregates to accommodate the passenger flows plus one (1) redundant standard faregate in case of outage and one (1) ADA faregate.

Figure 4-4: Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) (Plans)

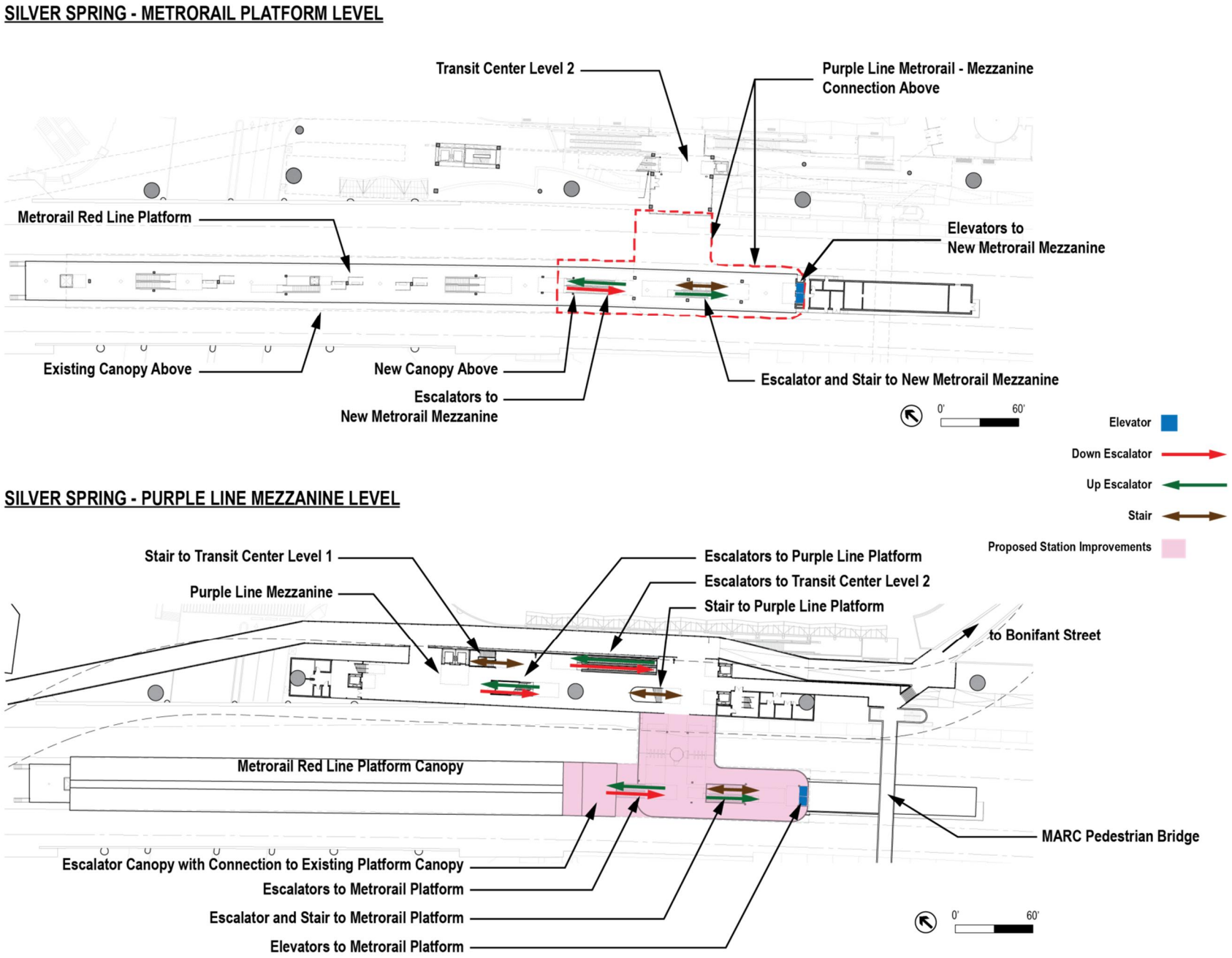
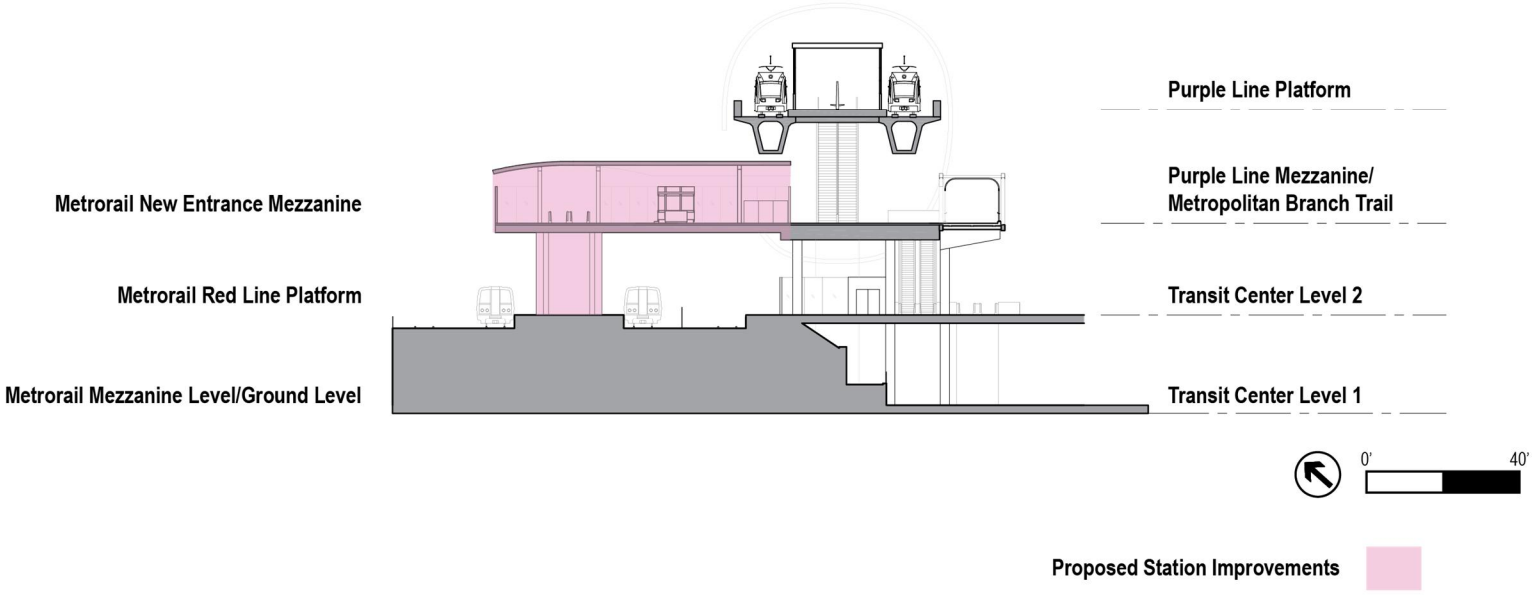
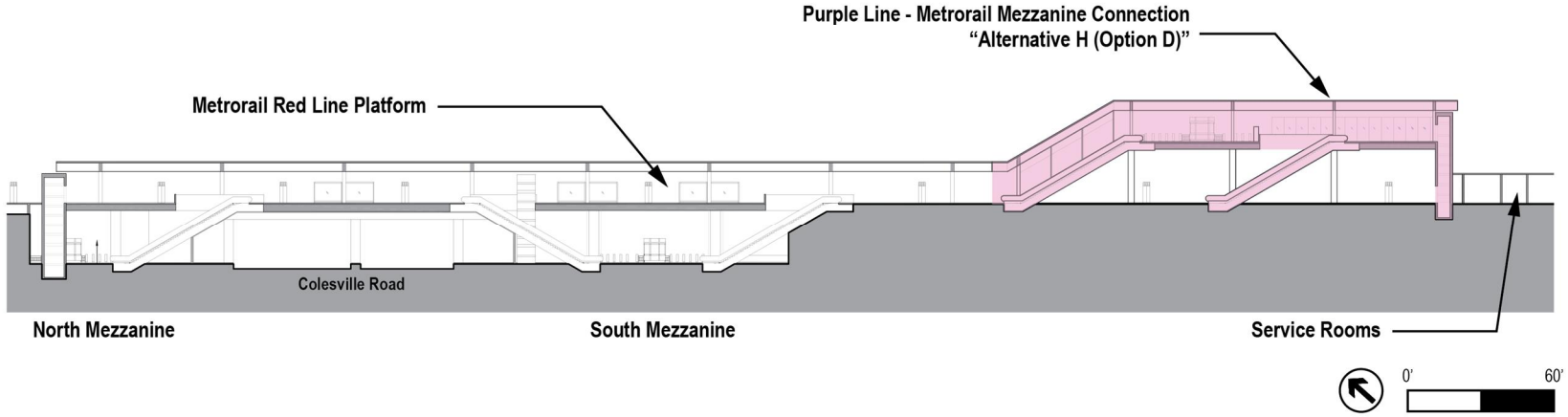


Figure 4-5: Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) (Sections)

CROSS SECTION



LONGITUDINAL SECTION OF METRORAIL PLATFORM



5.0 Comparison and Evaluation of Design Alternatives

This section compares the performance of the design alternatives relative to each other and to the future No Build condition. The comparison and evaluation includes:

- Improvement concept 2030 pedestrian model simulations;
- Conceptual capital cost estimates; and
- Summary evaluation based on quantitative and qualitative measures

For the principal station improvement concept, the Purple Line-Metrorail Mezzanine Connection, two alternatives (Alternative E and Alternative H (Option D) described in Section 4) were fully developed and advanced for pedestrian simulation modeling and evaluation. The North Mezzanine New Elevator concept was developed separately as an independent access improvement concept but would be included as part of a package of any major station improvements, and thus is included in the concept design plans and pedestrian model simulations for the Purple Line-Metrorail Mezzanine Connection. In the cost estimates and summary evaluation, the North Mezzanine New Elevator is treated as a separate alternative improvement.

5.1 Metrorail Station Passenger Volumes with New Station Entrance

The Purple Line-Metrorail Mezzanine Connection would provide a new station entrance for the Metrorail station, attracting a significant volume of Red Line passengers using the southeast entrance in the future No Build conditions. The following groups of station passengers would be expected to use the new entrance:

- Purple Line transfers;
- Transit Center level 2 bus transfers (a share would continue to use the southeast entrance);
- Transit Center level 3 Kiss & Ride facility users;
- Park & Ride access from the Montgomery County Bonifant-Dixon parking garage;
- Pedestrians and bicyclists coming from areas southeast of the station from Bonifant Street and the Metropolitan Branch Trail; and
- PM peak period MARC transfers.

The new station entrance would significantly reduce peak period demand at the southeast entrance. The 2030 forecast year, which is projected to have additional Purple Line ridership growth above 2020 opening year levels, was used for assessing the Purple Line-Metrorail Mezzanine Connection. **Figure 5-1** and **Figure 5-2** on the following pages illustrate Metrorail passenger entry and exit volumes by station entrance during the AM and PM peak hours, respectively, for 2030 No Build conditions and 2030 Build conditions (with the new entrance provided by the Purple Line-Metrorail Mezzanine Connection). The two build alternatives, Alternative E and Alternative H (Option D), provide the same new entrance and pedestrian circulation routes and were assumed to have the same passenger demand as shown in the Build conditions in **Figures 5-1** and **5-2**.

Figure 5-1: AM Peak Hour Metrorail Entries/Exits by Station Entrance

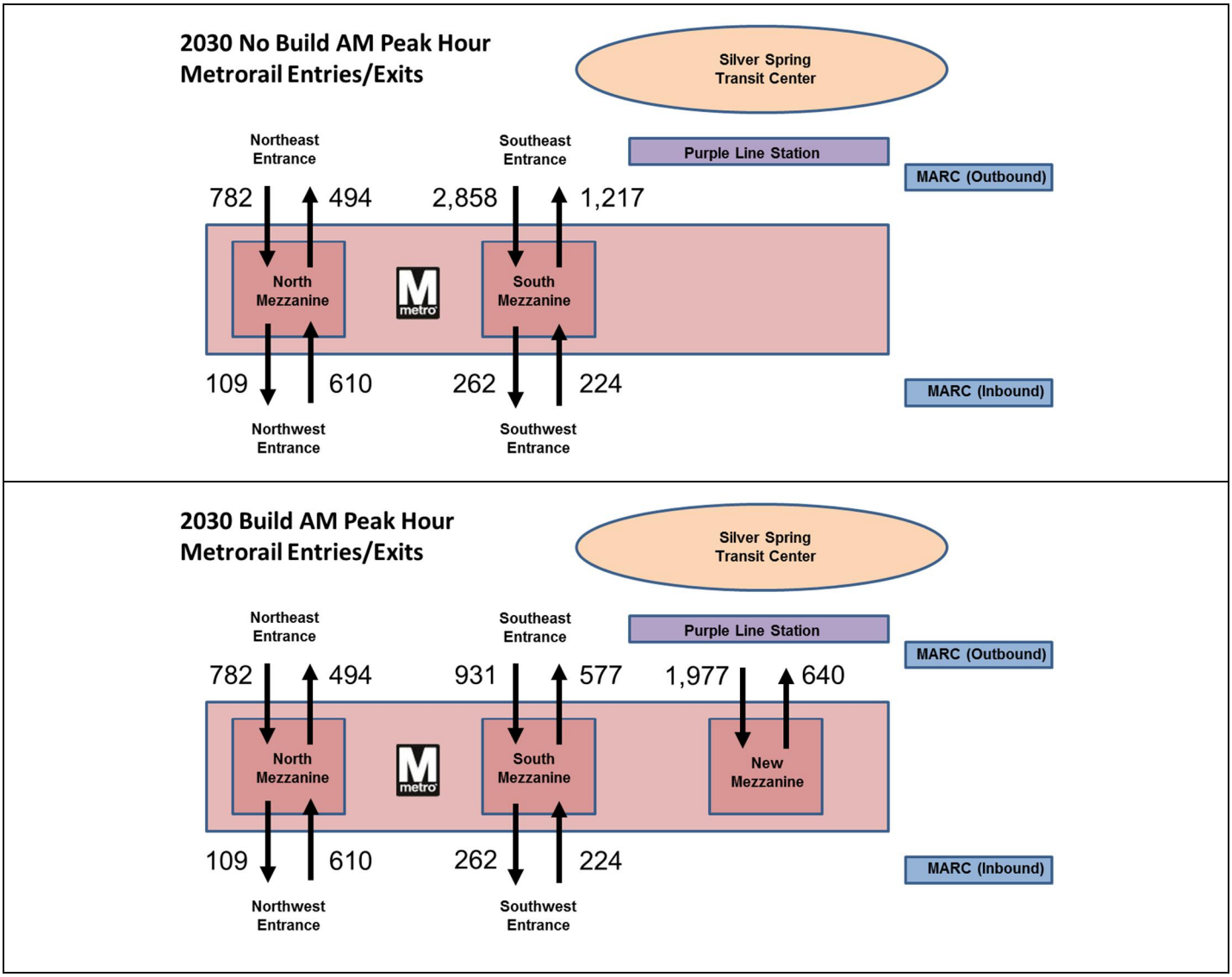
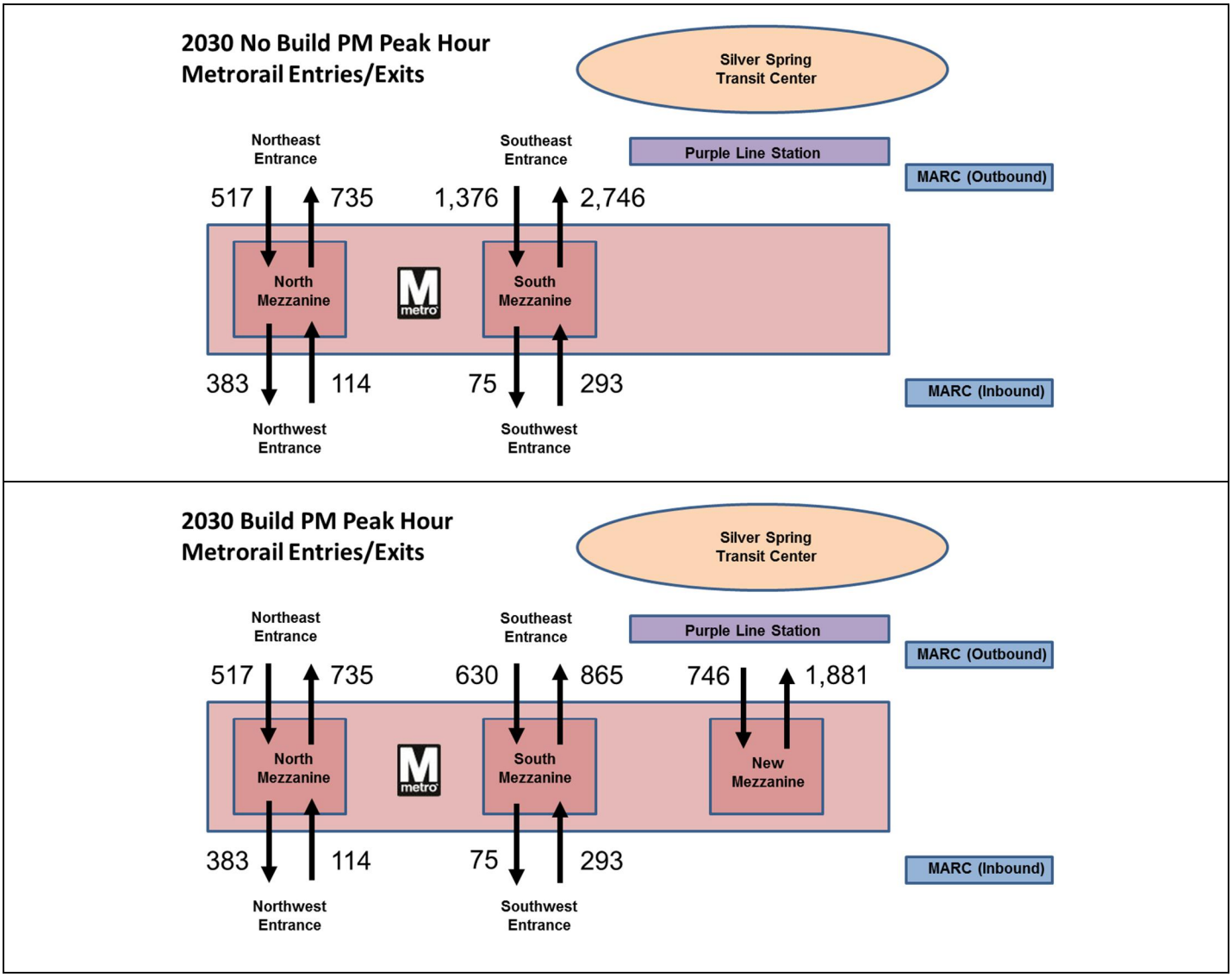


Figure 5-2: PM Peak Hour Metrorail Entries/Exits by Station Entrance



5.2 Improvement Concept 2030 Pedestrian Model Simulations

Pedestrian model simulations using the methodology described in Section 3.2 were conducted for the two Purple Line-Metrorail Mezzanine Connection alternatives in the forecast year 2030. The pedestrian model limits include the areas covered in the existing and future No Build simulations as well as the additional areas of the Purple Line-Metrorail Mezzanine Connection, including the mezzanine bridge connection, new Metrorail entrance facilities, and new escalators and stairs connecting to the Metrorail platform. The simulation results, using the passenger density maps and MOEs, compared the two build alternatives relative to each other and to the future 2030 No Build condition simulation results.

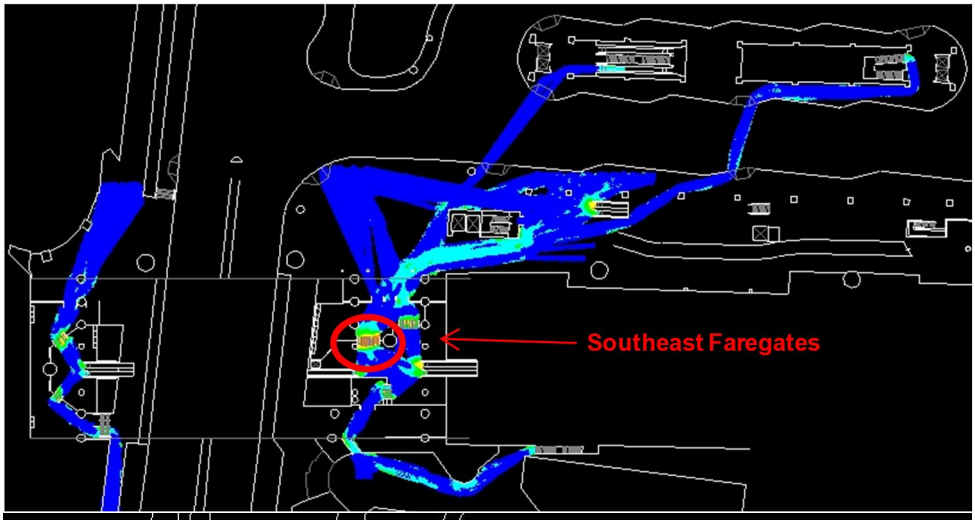
Comparison of 2030 No Build and Build Pedestrian Density

The comparison between the No Build and the Build Alternatives are shown in **Figure 5-3** through **Figure 5-8**. This comparison indicates that the Purple Line-Metrorail Mezzanine Connection, which provides an additional path for passengers to access the Transit Center and Purple Line mezzanine, greatly reduces the extent of high densities at the following areas:

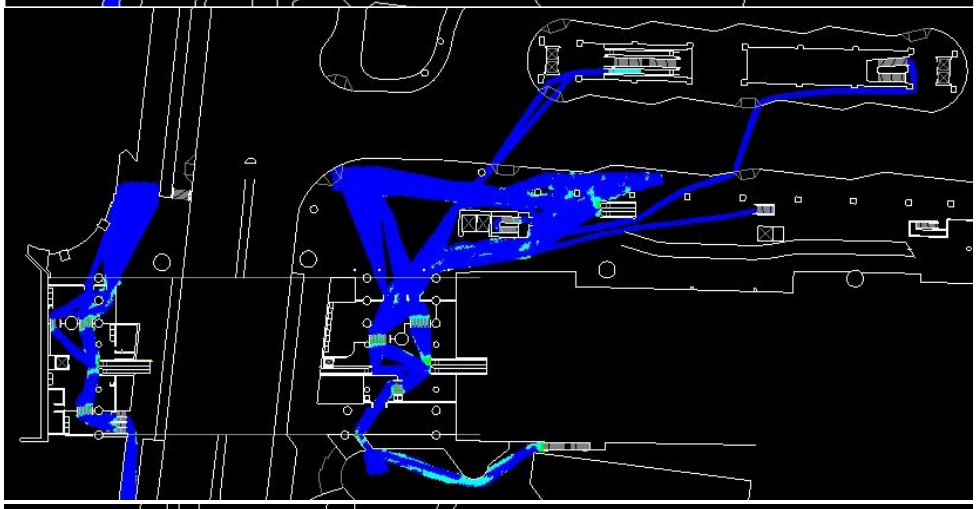
- Southeast faregates (see **Figure 5-3** and **Figure 5-6**);
- South mezzanine escalator (VCE #1 and VCE #2) on the Metrorail platform level (see **Figure 5-7**);
- Down escalator (VCE # 4) from Purple Line Mezzanine to Transit Center level 2 (see **Figure 5-5** and **Figure 5-8**); and
- Down escalator (VCE # 3) from Transit Center level 1 to ground level (see **Figure 5-4** and **Figure 5-7**).

Figure 5-3: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine/Transit Center Level 1

No Build 2030



Alternative E



Alternative H
(Option D)

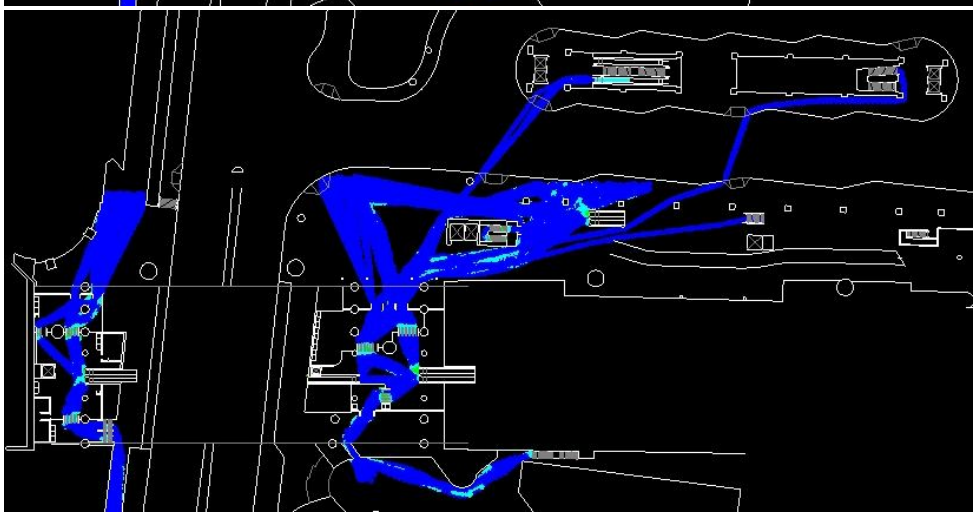
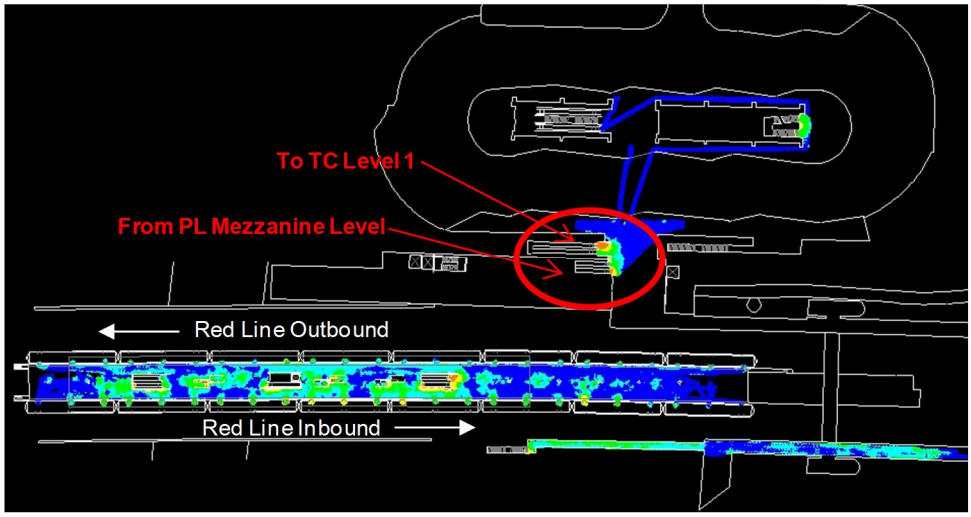
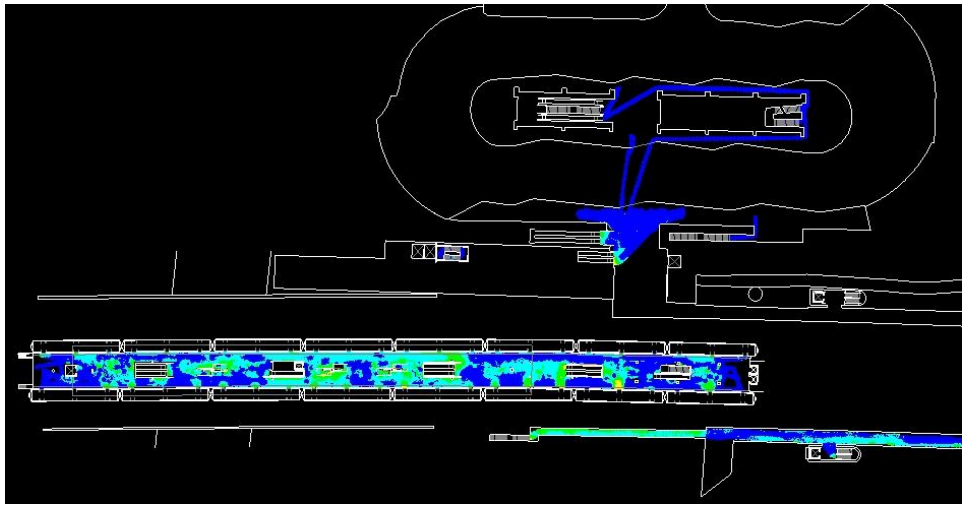


Figure 5-4: AM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform/Transit Center Level 2

No Build 2030



Alternative E



Alternative H
(Option D)

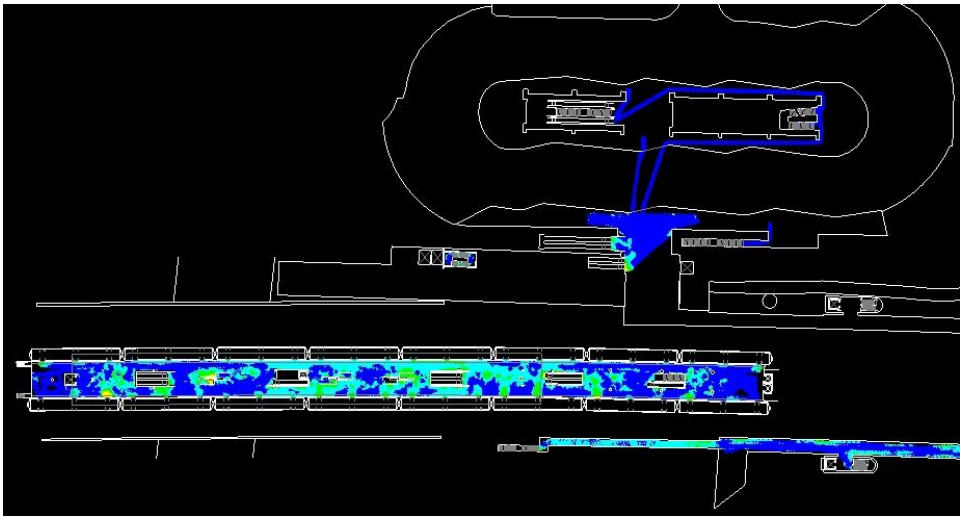


Figure 5-5: AM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level

No Build 2030

Alternative E

Alternative H
(Option D)

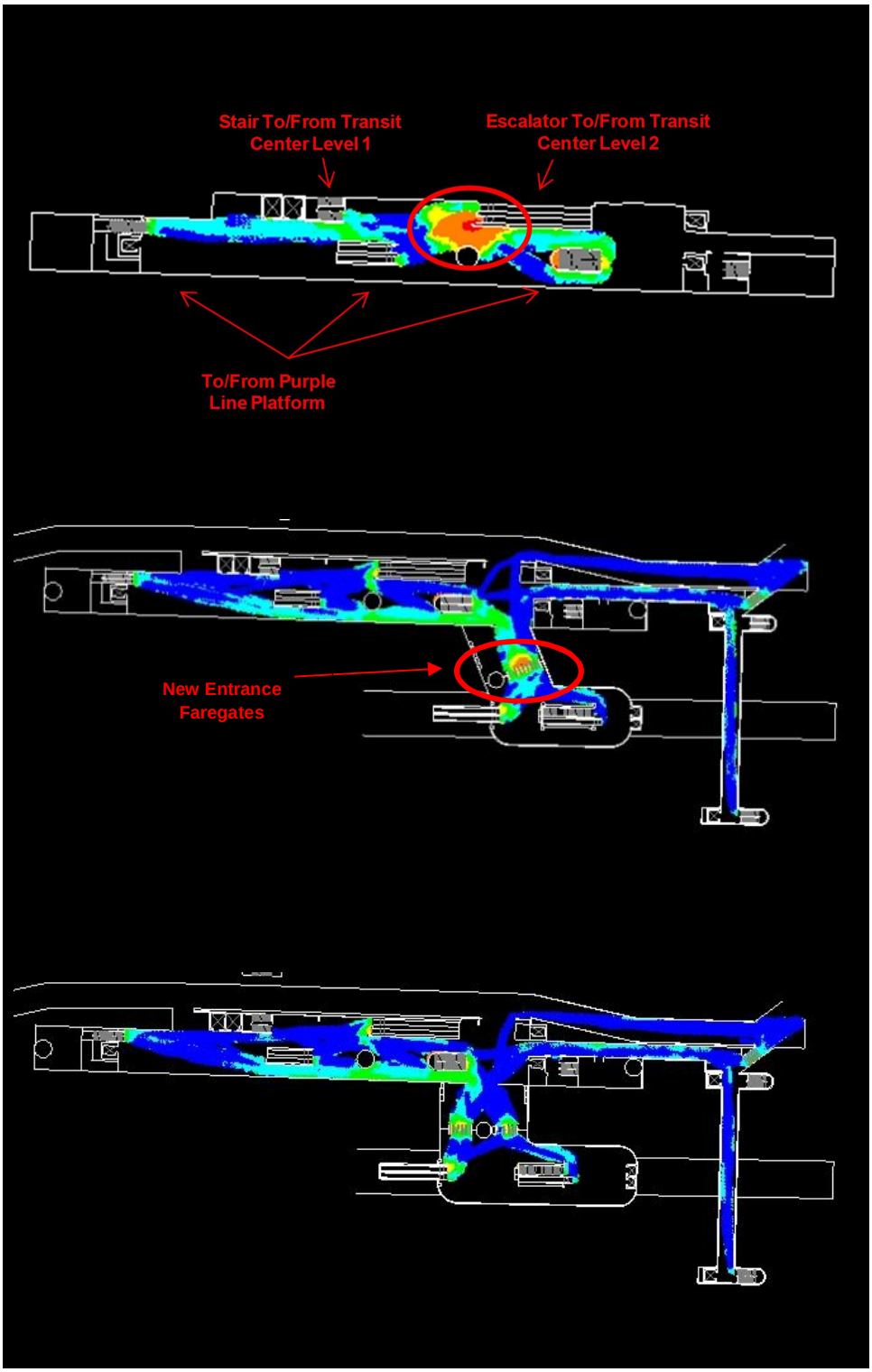
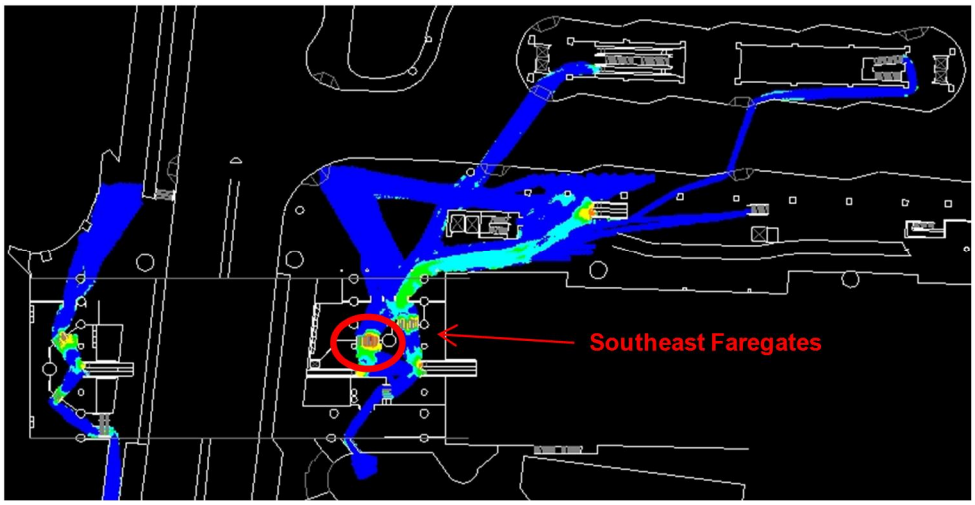


Figure 5-6: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Mezzanine/Transit Center Level 1

No Build 2030



Alternative E

Alternative H
(Option D)

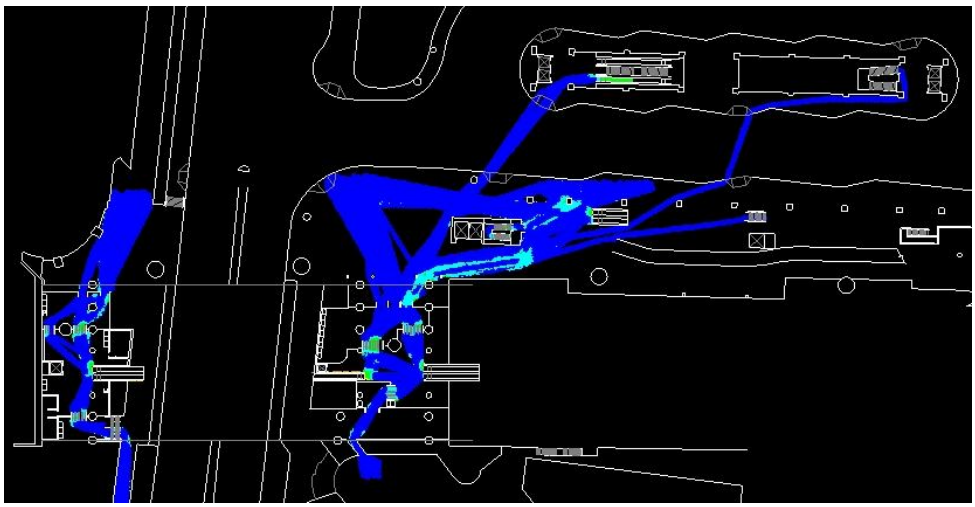
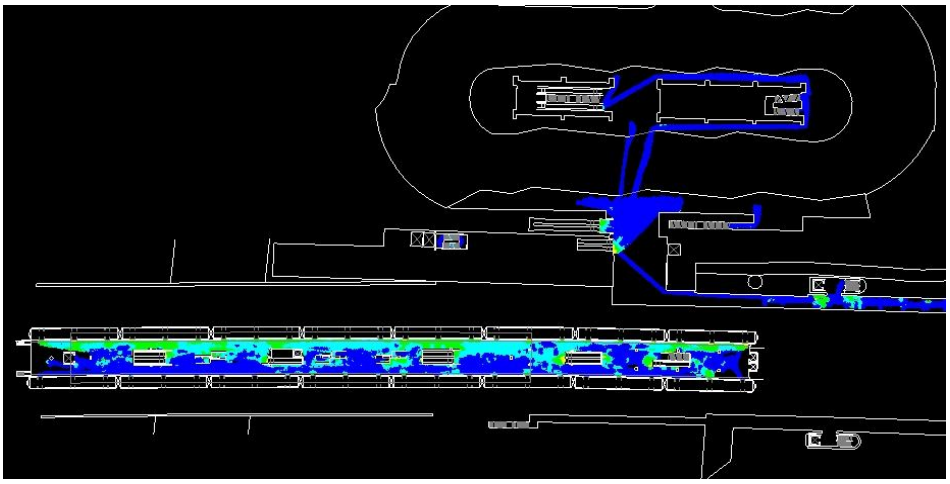


Figure 5-7: PM Peak 15 Minutes Cumulative Mean Density – Metrorail Platform/Transit Center Level 2

No Build 2030

Alternative E



Alternative H
(Option D)

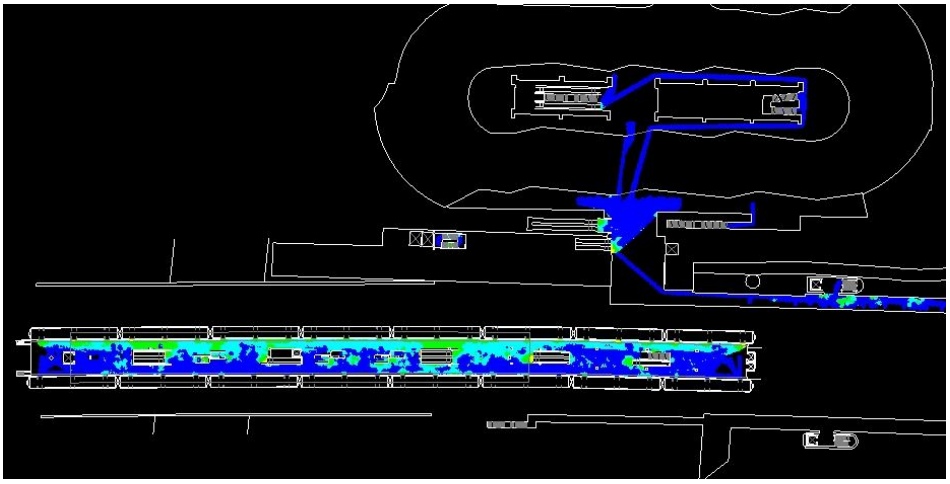
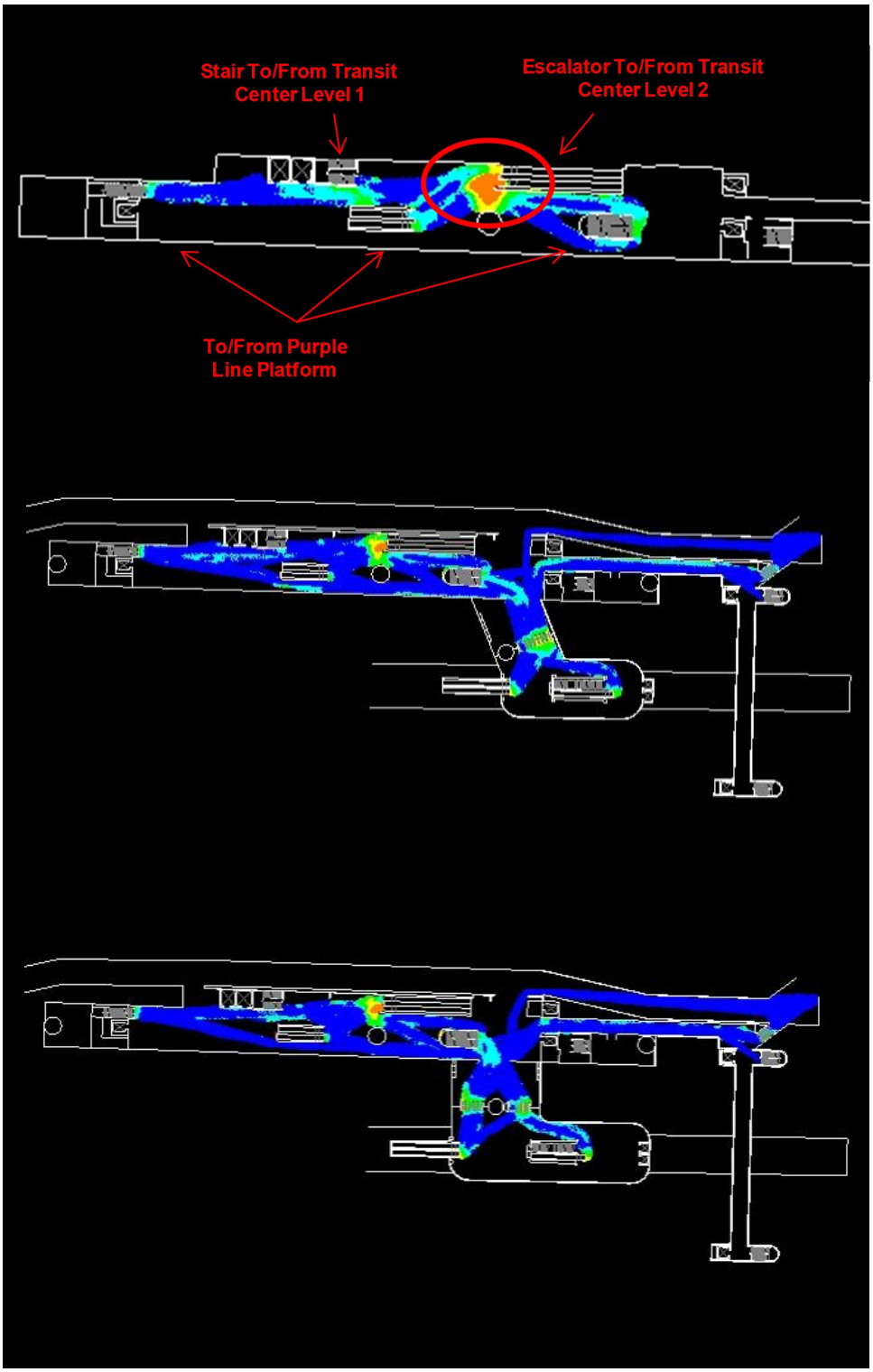


Figure 5-8: PM Peak 15 Minutes Cumulative Mean Density – Purple Line Mezzanine Level

No Build 2030

Alternative E

Alternative H
(Option D)



Zone Density Comparison

Figure 5-9 and **Figure 5-10** depict the analysis zones used for calculating the percentages of passengers in LOS E and F during the peak hour from the simulations.

Figure 5-9: Alternative E - Purple Line Mezzanine Level

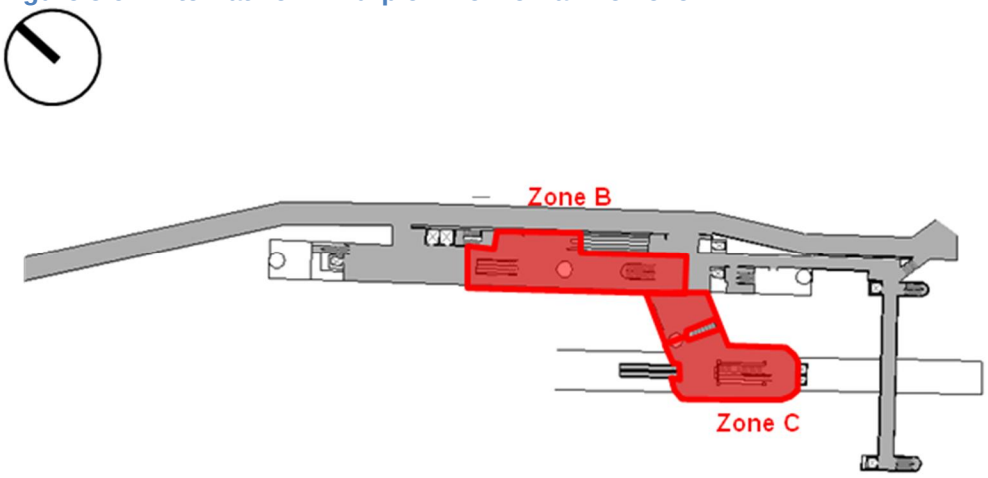


Figure 5-10: Alternative H (Option D) - Purple Line Mezzanine Level

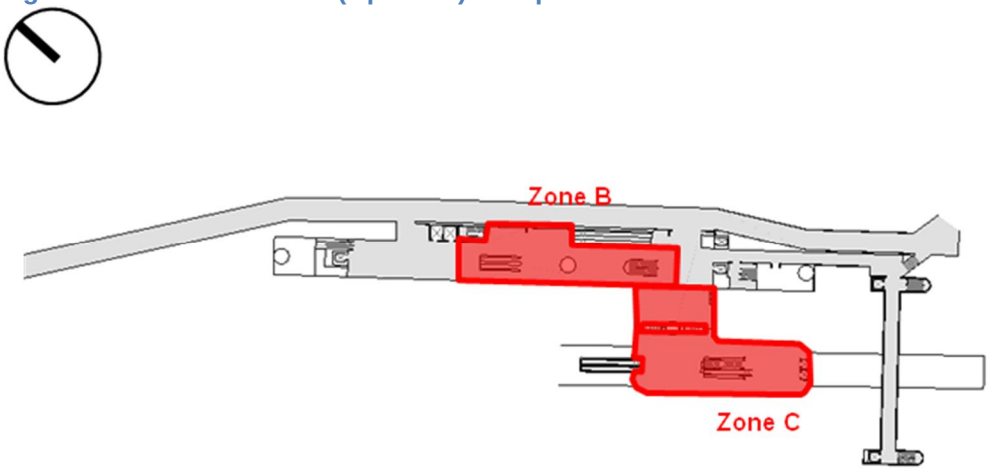


Table 5-1 lists the disaggregated and combined average LOS E and F during the AM and PM peak hours.

Table 5-1: AM and PM Peak Hour Zone Density Comparison (LOS E and F)

Analysis Zone		2030 No Build		2030 Alternative E		2030 Alternative H (Option D)	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Zone A Metrorail Platform	% LOS E	3	9	1	1	1	1
	% LOS F	0	1	0	0	0	0
	Combined % LOS E & F	3	10	1	1	1	1
Zone B Purple Line Mezzanine	% LOS E	**42**	17	2	9	2	10
	% LOS F	15	5	0	0	0	1
	Combined % LOS E & F	**57**	**22**	2	9	2	11
Zone C Purple Line - Metrorail Mezzanine Connection	% LOS E	-	-	11	1	3	0
	% LOS F	-	-	0	0	0	0
	Combined % LOS E & F	-	-	11	1	3	0

As shown in **Table 5-1**, the highest densities (combined LOS E and F over 20 percent) are recorded on the Purple Line mezzanine during the AM and PM peak hours in the future No Build condition. These high densities occur due to the high volume of unloading Purple Line passengers with only a single escalator and single stair to Transit Center level 2.

Alternative H (Option D) is the best performing design alternative primarily due to the additional path to the Purple Line mezzanine and sufficient faregate capacity at the new Metrorail entrance.

Station Threshold Analysis

As shown in **Table 5-2**, the Purple Line-Metrorail Mezzanine Connection alternatives reduce the overall passenger density within the analysis zones significantly below the defined maximum station-level density threshold of 20 percent of passengers experiencing LOS E and F.

Table 5-2: Combined Peak Hours and Zones Average Density Comparison (LOS E and F)

	Average % LOS E & LOS F		
	2030 No Build	2030 Alternative E	2030 Alternative H (Option D)
Zone A, B and C Combined	**23**	4	3

Comparison of 2030 No Build and Build Escalator Queues

Each design alternative provides a new access path for passengers between the Metrorail platform and Purple Line mezzanine. This path also provides an alternative for passengers whose destination is the Transit Center level 2. The additional path accounts for the significant reduction in clearance time despite the increased future transfer demand.

For both design alternatives during the AM and PM peak 15-minute periods, all VCEs perform well. However, minor queues remain for VCE #4 down to Transit Center level 2 from the Purple Line mezzanine based on the large demand from the Purple Line.

Table 5-3: Vertical Circulation Peak 15 Minutes Average Clearance Times (Minutes:Seconds)

Vertical Circulation Element		2030 No Build		2030 Alternative E		2030 Alternative H (Option D)	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Between Metrorail Platform and South Mezzanine	VCE 1 (Down)	(up operation)	**0:49**	(up operation)	No queue	(up operation)	No queue
	VCE 2 (Down)	**0:43**	**0:58**	No queue	No queue	No queue	No queue
Between Transit Center Level 2 and Transit Center Level 1	VCE 3 (Down)	**1:15**	No queue	No queue	No queue	No queue	No queue
Between Purple Line Mezzanine and Transit Center Level 2	VCE 4 (Down)	**2:13**	**1:02**	No queue	**0:30**	No queue	**0:30**
Between Metrorail Platform and Purple Line Mezzanine Level	VCE 5 (Up)	-	-	No queue	No queue	No queue	No queue
	VCE 6 (Up)	-	-	No queue	No queue	No queue	No queue

Journey Time

The Purple Line-Metrorail Mezzanine Connection alternatives results in significant reductions in journey times for Purple Line transfers compared to the 2030 No Build condition (see **Table 5-4**).[5]

Table 5-4: Metrorail-Purple Line Transfers Average AM and PM Peak Hour Journey Times

Origin / Destination	2030 No Build	2030 Alternative E	2030 Alternative H (Option D)
Purple Line / Red Line Platform	3:39	1:28	1:18
Red Line Platform / Purple Line	3:40	1:58	1:45

In the PM peak hour, the mezzanine connection also results in moderate reductions in journey times for Metrorail PM peak period egress to the southeast and southwest exits and to the Transit Center by relieving passenger congestion from the Red Line platform to the south mezzanine. The new Metrorail entrance also provides a more direct route and moderate reductions in PM peak hour journey times for Red Line egress to the outbound MARC platform and to the Transit Center Kiss & Ride facility.

[5] Note that, as the pedestrian simulations did not model the Purple Line platform level, the Purple Line journey times in all scenarios are measured to/from the escalators between the Purple Line Mezzanine Level and the Purple Line platform level and do not include walking time on the Purple Line platform between train cars and escalators and queuing for the escalators down to the Purple Line Mezzanine Level.

Faregate Queue Box Crowding Comparison

To compare the entrance capacity of the two design alternatives for the Purple Line-Metrorail mezzanine connection, passenger density was computed for the faregate queuing areas at the new Metrorail entrance. The percentage area of the faregate queue boxes that experienced LOS E or F was measured to estimate potentially uncomfortable or disruptive congestion. During the AM peak hour, Alternative E showed eight percent of the faregate queuing areas with LOS E or F, while Alternative H (Option D) had no LOS E or F in the faregate queuing areas due to its higher faregate capacity. Neither alternative had LOS E or F in the faregate queuing areas in the PM peak hour.

5.3 Capital Cost Estimates

Conceptual capital cost estimates for the three improvement concepts were developed based on WMATA specifications and industry practices. The estimates assume that the construction schedule coincides with Purple Line construction by MTA, from mid-2015 through mid-2020. Construction costs are based on current year dollars and contract costs are escalated to the mid-point of construction in late 2017. **Table 5-5** summarizes the estimated construction and project costs. **Appendix C** includes the detailed conceptual capital cost estimates.

Table 5-5: Conceptual Capital Cost Estimates

Cost Subtotal/Total	North Mezzanine New Elevator	Purple Line-Metrorail Mezzanine Connection Alternative E	Purple Line-Metrorail Mezzanine Connection Alternative H (Option D)
Construction Subtotal (2014 dollars)	$3,446,000	$9,860,000	$10,506,000
Construction Cost (2014 dollars; incl. Markups for general conditions & project requirements, bond, insurance, building permit)	$4,251,000	$12,163,000	$12,961,000
Contract Cost (Hard Costs only) (incl. Contingency & Escalation to mid-point of construction in 4th Quarter 2017)	$6,100,000	$17,452,000	$18,597,000
Total Contract Cost (Hard + Soft Costs) (incl. Design, Engineering, Design Mgmt., Constr. Support)	$9,149,000	$26,178,000	$27,896,000

5.4 Summary Evaluation of Improvement Concepts

A subset of key quantitative and qualitative measures was used to evaluate the design alternatives for the degree to which they:

- Improve station accessibility;
- Enhance pedestrian circulation conditions; and
- Are feasible to construct.

Table 5-6 lists the selected key evaluation measures and summarizes the results for each alternative. The measures and results are described in more detail below.

Table 5-6: Design Alternatives Evaluation Matrix

Evaluation Measure	No Build 2030	North Mezzanine New Elevator	Alternative E	Alternative H (Option D)
Accessibility				
Increase ADA access	No	1 new elevator	2 new elevators; New entrance avoids grade to SE	2 new elevators; New entrance avoids grade to SE
Pedestrian Simulation Measures of Effectiveness				
Mean Density (AM/PM Peak Hr. Combined Percent LOS E & F) Combined AM/PM Average	23%	(Assumed same as No Build)	4%	3%
Metrorail Platform (AM/PM)	3% / 10%		1% / 1%	1% / 1%
Purple Line Mezzanine (AM/PM)	57% / 22%		2% / 9%	2% / 11%
New Metrorail Entrance Mezz. (AM/PM)	n/a		11% / 1%	3% / 0%
Escalator clearance time (mins: secs, for key congested VCEs) *Metro Platform to South Mezz. Down Escalator (PM Peak Hr.)*	0:58		No queue	No queue
Purple Line Mezz. to TC Level 2 Down Escalator (AM Peak Hr.)	1:58		No queue	No queue
New Entrance Faregate Crowding (AM/PM) (Queue box Peak Hour Combined Percent LOS E & F)	n/a		8% / 0%	0% / 0%
Journey Time (AM/PM Peak Hour average) *Purple Line to Metrorail Platform*	3:39		1:28	1:18
Metrorail Platform to Purple Line	3:40		1:58	1:45
Implementation Factors				
Conceptual Capital Cost	n/a	$9.1 M	$26.1 M	$27.9 M
Construction Duration	n/a	12 months	5 years (w. Purple Line)	5 years (w. Purple Line)
Earliest Timeframe for Implementation	n/a	2017	2020 at earliest (w. Purple Line)	2020 at earliest (w. Purple Line)
Construction Feasibility	n/a	High Does not require complete closure of North Mezzanine	Medium Requires phased implementation in conjunction with PL Line; Construction over live CSXT and Metrorail tracks	Medium Requires phased implementation in conjunction with PL Line; Construction over live CSXT and Metrorail tracks

n/a = not applicable

5.4.1 Accessibility

Measures

The ability of the alternatives to improve ADA accessibility to the station and within the station, such as whether it provides elevator redundancy, improves access at the north mezzanine, or otherwise enhances access to the station for patrons with mobility impairments.

Key Results

- *North Mezzanine New Elevator* – as a stand-alone alternative, would extend ADA access to the north mezzanine.
- *Purple Line-Metrorail Mezzanine Connection* – Alternative E and Alternative H (Option D) –provide additional elevator access (two elevators from the Metrorail platform to the Purple Line mezzanine level). The accessible new entrance would serve the southeastern station vicinity, including transfers to bus and Purple Line, and provide an accessible pathway that avoids the grade between the existing southeast entrance at Colesville Road and areas to the southeast of the station.

Note that any major station improvements, such as the Purple Line-Metrorail Mezzanine Connection, would be expected to separately address the North Mezzanine New Elevator basic ADA access upgrade recommended for the existing station facilities. As a result, the Alternative E and Alternative H (Option D) concept plans show incorporation of the North Mezzanine New Elevator; however, the North Mezzanine New Elevator cost is separated out in the cost estimates.

5.4.2 Pedestrian Simulation Measures of Effectiveness (MOEs)

Measures

Several of the MOEs used in the analysis of the pedestrian simulation results reported in Section 5.2 were selected for the summary evaluation. The following MOEs provide an overall summary of pedestrian conditions and distinguish the performance of the alternatives:

- *Mean Density* – percentage of people in Level of Service (LOS) E and F during the peak 15-minute period, combined average for AM and PM peak.
- *Escalator Queue Length* – average clearance time (seconds): This represents the average time recorded in seconds that it takes to clear a queue at an escalator or stair. Two key escalators with queues in the 2030 No Build condition are included in the evaluation table for comparison:
    - Metro platform to south mezzanine down escalator (PM peak hour)
    - Purple Line mezzanine to Transit Center level 2 down escalator (AM peak hour)
- *New Entrance Fare Gate Crowding* – percentage of the fare gate queuing area with pedestrian LOS E and F. This analysis was conducted for the Metrorail new entrance at the Purple Line-Metrorail mezzanine connection to compare how the two alternatives handle passenger flows.
- *Journey Time* – time taken (minutes:seconds) by a person to complete his course through a station model, as measured from the second a person enters the model to the second he reaches his destination within the station (e.g., train platform waiting area or station exit). The only passenger movement with a significant journey time difference between the 2030 No Build condition and the build alternatives was transfer between Metrorail and the Purple Line, so the two origin-destination pairs used in the evaluation for this measure are:

- Purple Line mezzanine to Metrorail platform (combined AM/PM peak hour average)[6]
- Metrorail platform to Purple Line mezzanine (combined AM/PM peak hour average)

Key Results

- Alternatives E and H (Option D) significantly improve pedestrian conditions at the Metrorail station south mezzanine, platform level, and Purple Line mezzanine level compared to 2030 No Build conditions. The new Metrorail entrance relieves the heavy demand on the southeast entrance and provides an additional route from the Purple Line mezzanine to the Metrorail platform. The journey time for Purple Line to Metrorail transfers is almost half.
- Alternative H (Option D) performs better than Alternative E in terms of the Metrorail entrance capacity by eliminating the AM peak faregate crowding that Alternative E has. Otherwise, the two alternatives perform similarly in the pedestrian measures elsewhere in the station.

5.4.3 Implementation Factors

Measures

The Conceptual Design task included estimation of conceptual capital costs and considered potential implementation phasing in conjunction with the planned Purple Line station construction and broad constructability issues in a high-level, qualitative manner.

- *Conceptual capital cost* – order-of-magnitude cost estimates reported in Section 5.3. The Purple Line-Metrorail Mezzanine Connection alternative cost estimates and the North Mezzanine New Elevator cost estimate are provided separately.
- *Construction duration* – order-of-magnitude range for construction duration.
- *Earliest timeframe for implementation* – general approximation for how soon the alternative could be implemented and in operation.
- *Construction feasibility* – qualitative relative complexity and feasibility of issues that would need to be addressed, such as potential effect on station operations during construction.

Key Results

- Construction of the Purple Line-Metrorail Mezzanine Connection alternatives will depend on Purple Line construction schedule, which is currently assumed to be five years in duration.
- A stand-alone North Mezzanine New Elevator improvement could be implemented separately and sooner than the Purple Line project.
- The Purple Line-Metrorail Mezzanine Connection alternatives will need to be phased in conjunction with the Purple Line station construction:
    - Construction of the Purple Line station will severely restrict heavy equipment access to the Metrorail station from the east side.

[6] Note that, as the pedestrian simulations did not model the Purple Line platform level, the Purple Line journey times in all scenarios are measured to/from the escalators between the Purple Line Mezzanine Level and the Purple Line platform level and do not include travel time on the Purple Line platform between train cars and escalators and queuing for the escalators down to the Purple Line Mezzanine Level.

  - The portion of the new Metrorail entrance mezzanine above the Metrorail platform, as well as VCEs to and from the platform, would be more easily constructed before the Purple Line station is built.
  - The Mezzanine connection bridge would need to be built later during construction of the Purple Line station. Construction of the mezzanine bridge above the active Metrorail and CSXT tracks would require special consideration.

- For all construction at the platform level, access is restricted by the center platform layout. Some equipment and materials could be brought in on Metrorail service cars.

6.0 Conclusion

The Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) best accommodates future ridership growth, facilitates transfer access to and from the Purple Line and Transit Center, and provides an additional access point to the station. Overall, Alternative H (Option D):

- Addresses 2030 No Build deficiencies;
- Handles passenger flow better than Alternative E;
- Provides additional space for future needs; and
- Can be implemented at relatively minor additional cost compared to Alternative E.

The study also identified the following improvements, which could be implemented independently of the Purple Line in the short term, to address existing station access deficiencies:

- North mezzanine new elevator, reconfigured layout, and additional faregates; and
- Southwest entrance additional faregate, to provide redundancy in case of faregate outage and relieve use of ADA gate.

Appendix A:
North Mezzanine New Elevator Concept Drawings

section key

TRANSIT CENTER PEDESTRIAN PLAZA

ELEVATOR & STAIR TO/FROM TRANSIT CENTER LEVEL 3

ESCALATORS TO/FROM TRANSIT CENTER LEVEL 2

2 A3.1

STAIR TO/FROM TRANSIT CENTER LEVEL 2

ELEVATOR TO/FROM TRANSIT CENTER LEVEL 2 & 3

1 A3.1

FARE MACHINES

BRIDGE ABOVE

RELOCATED FARE MACHINES

RELOCATED KIOSK AND FARE GATES

ESCALATOR TO METRO PLATFORM

NEW ELEVATOR TO METRO PLATFORM

SOUTH MEZZANINE

ELEVATOR TO/FROM METRO PLATFORM

ESCALATOR TO METRO PLATFORM

NORTH MEZZANINE

NEW FARE MACHINES

NEW ELEVATOR MACHINE ROOM

NEW BREAK ROOM

COLESVILLE ROAD WESTBOUND

COLESVILLE ROAD EASTBOUND

FARE MACHINES

1 A3.2

RELOCATED FARE GATES

RELOCATED FARE MACHINES

TC LEVEL 3

TC LEVEL 2

TC LEVEL 1

PL PLATFORM

PL METRO MEZZANINE

METRO PLATFORM

METRO MEZZANINE

KGP design studio
1099 14th St. NW Suite 101 L
Washington, DC 20005
t 202.822.2102 f 202.822.2104
washington honolulu manila

metro

AECOM

N

30' 0 30'

SILVER SPRING STATION CAPACITY ANALYSIS STUDY

DRAWING NO. A0.0

SILVER SPRING STATION - METRORAIL MEZZANINE LEVEL (TRANSIT CENTER LEVEL 1)

KGP PROJECT NO. 1301

DESCRIPTION:
ELEVATOR ACCESS IMPROVEMENTS

DATE: 02/26/2014

P:\1301_Silver_Spring_Metro_Station\SUBMITTAL\SYNOPSIS_SUBMITTAL\130117_CAD Files_Alt E & F Silver Spring Metro Station_13011A0.0.dwg Feb 26, 2014 - 5:03pm

TRANSIT CENTER LEVEL 2

STAIR TO/FROM PURPLE LINE MEZZANINE LEVEL

ELEVATOR TO/FROM PURPLE LINE MEZZANINE LEVEL

PURPLE LINE MEZZANINE ABOVE

COLESVILLE ROAD BELOW

ESCALATORS TO/FROM TRANSIT LEVEL 1

2 A3.1

STAIR TO/FROM TRANSIT LEVEL 1

ELEVATOR TO/FROM TRANSIT CENTER 1,2 & 3

1 A3.1

RAMP DOWN TO/FROM TRANSIT LEVEL 1

ESCALATORS TO/FROM PURPLE LINE MEZZANINE ABOVE

MARC PLATFORM

WESTBOUND MARC

NEW ELEVATOR TO/FROM NORTH MEZZANINE

ESCALATORS TO/FROM NORTH MEZZANINE

OUTBOUND METRO

ESCALATORS TO/FROM SOUTH MEZZANINE

CANOPY ABOVE

EX WMATA ANCILLARY ROOMS

MARC PEDESTRIAN BRIDGE ABOVE

METRO PLATFORM LEVEL ELEV: 330'-0"

INBOUND METRO

ESCALATOR TO/FROM SOUTH MEZZANINE

ELEVATOR TO/FROM SOUTH MEZZANINE

BENCH AND WINDSCREEN

EASTBOUND MARC

COLESVILLE ROAD BELOW

EX STAIR DOWN TO WMATA MEZZANINE LEVEL/ COLESVILLE ROAD

TC LEVEL 3

TC LEVEL 2

TC LEVEL 1

PL PLATFORM

PL MEZZANINE

METRO PLATFORM

METRO MEZZANINE

SECTION KEY

KGP design studio
1099 14th St. NW Suite 101 L
Washington, DC 20005
t 202.822.2102 f 202.822.2104
washington honolulu manila

metro

AECOM

N

30' 0 30'

SILVER SPRING STATION CAPACITY ANALYSIS STUDY

SILVER SPRING STATION - METRORAIL PLATFORM LEVEL (TRANSIT CENTER LEVEL 2)

DESCRIPTION:
ELEVATOR ACCESS IMPROVEMENTS

KGP PROJECT NO. 1301

DRAWING NO. A0.1

DATE: 02/26/2014

P:\1301_Silver_Spring_Metro_Station\100_Drawings\1320_Base\A0_01_Platform+Elevator Access Improvements.dwg Aug 23, 2013 - 12:29pm

Appendix B:
Purple Line-Metrorail Mezzanine Connection Alternative H (Option D) Concept Drawings

section key

TRANSIT CENTER PEDESTRIAN PLAZA

ELEVATOR & STAIR TO/FROM TRANSIT CENTER LEVEL 3

ESCALATORS TO/FROM TRANSIT CENTER LEVEL 2

2 A3.1

STAIR TO/FROM TRANSIT CENTER LEVEL 2

ELEVATOR TO/FROM TRANSIT CENTER LEVEL 2 & 3

1 A3.1

EL=305.00'

EL=306.08'

EL=321.9'

EL=313.0'

EL=323.0'

FARE MACHINES

BRIDGE ABOVE

RELOCATED FARE MACHINES

RELOCATED KIOSK AND FARE GATES

ESCALATOR TO METRO PLATFORM

NEW ELEVATOR TO METRO PLATFORM

EL=308.00'

COLESVILLE ROAD WESTBOUND

COLESVILLE ROAD EASTBOUND

SOUTH MEZZANINE

ELEVATOR TO/FROM METRO PLATFORM

ESCALATORS TO/FROM METRO PLATFORM

NORTH MEZZANINE

NEW FARE MACHINES

NEW ELEVATOR MACHINE ROOM

NEW BREAK ROOM

FARE MACHINES

1 A3.2

RELOCATED FARE GATES

RELOCATED FARE MACHINES

SECTION KEY

TC LEVEL 3

TC LEVEL 2

TC LEVEL 1

PL PLATFORM

PL METRO MEZZANINE

METRO PLATFORM

METRO MEZZANINE

KGP design studio
1099 14th St. NW Suite 101 L
Washington, DC 20005
t 202.822.2102 f 202.822.2104
washington honolulu manila

metro

AECOM

30' 0 30'

SCALE: 1" = 30'

SILVER SPRING STATION CAPACITY ANALYSIS STUDY

DRAWING NO. A0.0

SILVER SPRING STATION - METRORAIL MEZZANINE LEVEL (TRANSIT CENTER LEVEL 1)

KGP PROJECT NO. 1301

DESCRIPTION:
PURPLE LINE CONNECTION ALTERNATIVE H opt D

DATE: 01/30/2014

P:\1301_SilverSpring_Metro_Station\SUBMITTALS\140128_PDF Alternative H opt D_Silver Spring Metro Station_130114A.dwg Jan 30, 2014 - 10:22am

section key

TRANSIT CENTER LEVEL 2
ELEV: 330'=0"

ELEVATORS & STAIR TO/FROM TRANSIT CENTER LEVEL 3

CCT ABOVE

PURPLE LINE MEZZANINE ABOVE

EX ESCALATORS TO/FROM TRANSIT LEVEL 1

2 A3,1

EX STAIR TO/FROM TRANSIT LEVEL 1

EX ELEVATOR TO/FROM TRANSIT CENTER 1,2 & 3

CCT ABOVE

COLESVILLE ROAD BELOW

RAMP TO/FROM TRANSIT LEVEL 1

ESCALATORS TO/FROM PURPLE LINE MEZZANINE ABOVE

EL=330.00'

WESTBOUND MARC

MARC PLATFORM

LINE OF MEZZ ABOVE

NEW ESCALATOR & STAIR TO/FROM NEW MEZZANINE LEVEL

NEW ELEVATOR TO/FROM NORTH MEZZANINE

EX ESCALATORS TO/FROM NORTH MEZZANINE

EX CANOPY ABOVE

OUTBOUND METRO

EX ESCALATORS TO/FROM SOUTH MEZZANINE

NEW CANOPY ABOVE

EL=330.00'

EL=330.00'

EX METRO ANCILLARY ROOMS

1 A3,2

INBOUND METRO

EX ESCALATOR TO/FROM SOUTH MEZZANINE

EX ELEVATOR TO/FROM SOUTH MEZZANINE

EX BENCH AND WINDSCREEN

NEW STRUCTURAL CANOPY COLUMNS

NEW ESCALATORS TO/FROM NEW MEZZANINE LEVEL

NEW STRUCTURAL COLUMNS

NEW ELEVATORS TO/FROM NEW MEZZANINE LEVEL

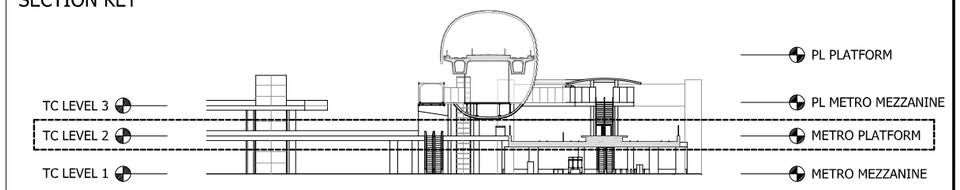
EX MARC PEDESTRIAN BRIDGE ABOVE

EASTBOUND MARC

MARC PLATFORM

COLESVILLE ROAD BELOW

SECTION KEY



KGP design studio
1099 14th St. NW Suite 101 L
Washington, DC 20005
t 202.822.2102 f 202.822.2104
washington honolulu manila

metro

AECOM

30' 0 30'

SCALE: 1" = 30'

SILVER SPRING STATION CAPACITY ANALYSIS STUDY

DRAWING NO. A1.1

SILVER SPRING STATION - METRORAIL PLATFORM LEVEL (TRANSIT CENTER LEVEL 2)

KGP PROJECT NO. 1301

DESCRIPTION:
PURPLE LINE CONNECTION ALTERNATIVE H opt D

DATE: 01/30/2014

P:\1301_Silver_Spring_Metro_Station\SUBMITTALS\140128_PDF Alternative H opt D_Silver Spring Metro Station_13A01A1.dwg Jan 30, 2014 - 10:15am

section key

TRANSIT CENTER LEVEL 3
ELEV: 355'=0"

STAIR TO/FROM PURPLE LINE PLATFORM
ELEVATOR TO/FROM PURPLE LINE PLATFORM
ACCESS TO CCT
ELEVATOR TO/FROM TRANSIT LEVEL 1
STAIR TO/FROM TRANSIT LEVEL 1

2 A3.1

ESCALATOR TO/FROM TRANSIT LEVEL 2
STAIR TO/FROM PURPLE LINE PLATFORM
ACCESS TO CCT
ELEVATOR TO/FROM TRANSIT CENTER 1,2 & 3
ELEVATOR TO/FROM PURPLE LINE PLATFORM

1 A3.1

SLOPED WALKWAY TO TC LEVEL 3

CAPITAL CRESCENT TRAIL (CCT)

EL=348.66'

EL=355.00'

LINE OF TRACK ABOVE

PURPLE LINE MEZZANINE

ESCALATORS TO/FROM PURPLE LINE PLATFORM

NEW FARE MACHINES
NEW FARE GATES & KIOSK
FUTURE GATE
NEW FARE MACHINES
NEW STRUCTURAL COLUMNS

55'-5"

EMERGENCY EGRESS STAIR

METRO MEZZANINE AREA
NEW ELEVATORS TO/FROM METRO PLATFORM

EX MARC PEDESTRIAN BRIDGE

EL=355.00'

1 A3.2

41'-8"
41'-8"
41'-8"
40'-6"

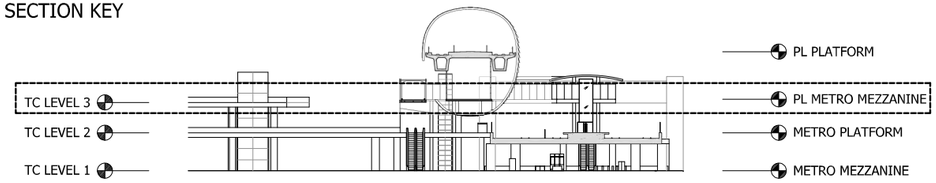
EX CANOPY BELOW

NEW CANOPY ABOVE ESCALATOR
NEW ESCALATORS TO METRO PLATFORM

NEW ESCALATOR & STAIR TO/FROM METRO PLATFORM

COLESVILLE ROAD BELOW

SECTION KEY



KGP design studio
1099 14th St. NW Suite 101 L
Washington, DC 20005
t 202.822.2102 f 202.822.2104
washington honolulu manila

metro

AECOM

30' 0 30'
SCALE: 1" = 30'

SILVER SPRING STATION CAPACITY ANALYSIS STUDY

SILVER SPRING STATION - PURPLE LINE MEZZANINE LEVEL (TRANSIT CENTER LEVEL 3)

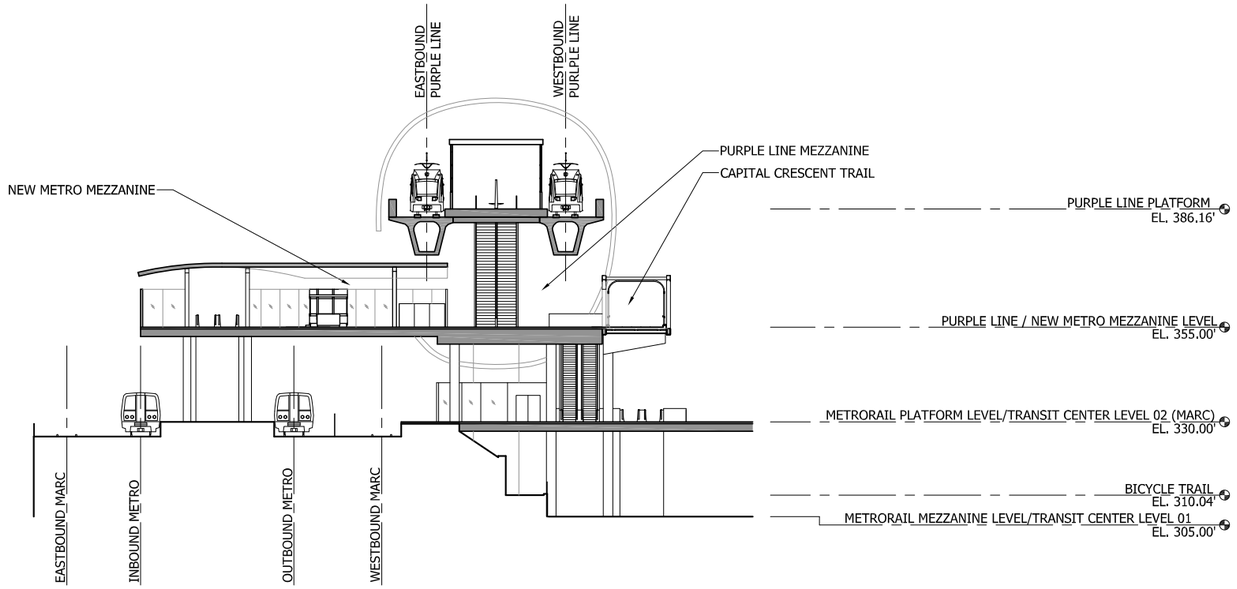
DESCRIPTION:
PURPLE LINE CONNECTION ALTERNATIVE H opt D

DRAWING NO.
A1.2

KGP PROJECT NO.
1301

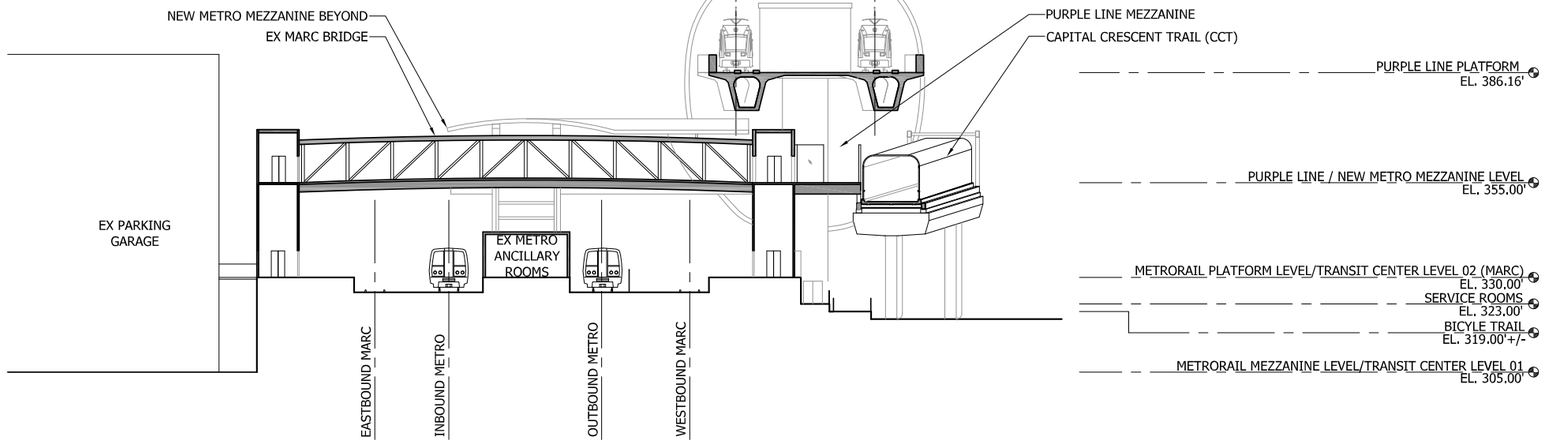
DATE: 01/30/2014

P:\1301_Silver_Spring_Metro_Station\SUBMITTALS\140128_PDF Alternative H opt D_Silver Spring Metro Station_1301A1.2.dwg Jan 30, 2014 - 10:15am



2 SECTION - AT PURPLE LINE MEZZANINE

SCALE: 1" = 20'



1 SECTION - THROUGH MARC PEDESTRIAN BRIDGE

SCALE: 1" = 20'

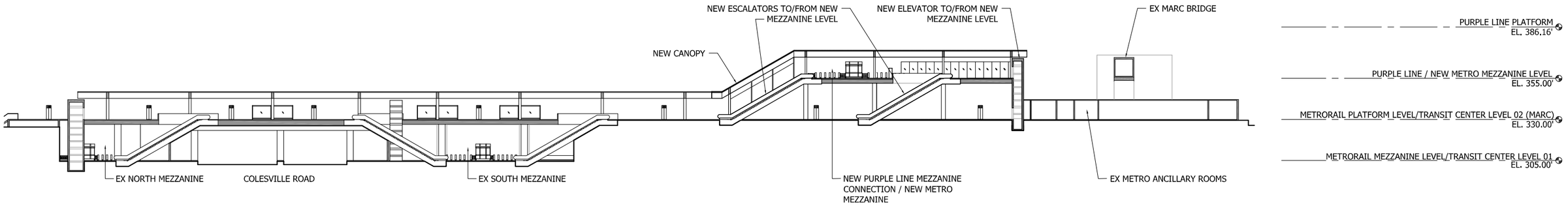
KGP design studio
1099 14th St. NW Suite 101 L
Washington, DC 20005
t 202.822.2102 f 202.822.2104
washington honolulu manila

metro

AECOM

SILVER SPRING STATION CAPACITY ANALYSIS STUDY	DRAWING NO. A3.1
SILVER SPRING STATION - CROSS SECTIONS (ALT H opt D)	KGP PROJECT NO. 1301
DESCRIPTION: PURPLE LINE CONNECTION ALTERNATIVE H opt D	DATE: 01/30/2014

P:\1301_Silver_Spring_Metro_Station\SUBMITTALS\140128_PDF Alternative H opt D_Silver Spring Metro Station_13X11A3.1.dwg Jan 30, 2014 - 10:16am



1 LONGITUDINAL SECTION
SCALE: 1" = 30'

KGP design studio
1099 14th St. NW Suite 101 L
Washington, DC 20005
t 202.822.2102 f 202.822.2104
washington honolulu manila

metro

AECOM

SILVER SPRING STATION CAPACITY ANALYSIS STUDY

SILVER SPRING STATION - LONGITUDINAL SECTION (ALT H opt D)

DESCRIPTION:
PURPLE LINE CONNECTION ALTERNATIVE H opt D

DRAWING NO. A3.2

KGP PROJECT NO. 1301

DATE: 01/30/2014

P:\1301_Silver_Spring_Metro_Station\SUBMITTALS\FINAL_SUBMITTALS\140128_PDF Alternative H opt D_Silver Spring Metro Station_1301\A3.2.dwg Jan 30, 2014 - 10:27am

Appendix C:
Conceptual Capital Cost Estimates for Improvement Concepts

February 20, 2014

AECOM

FEASIBILITY STUDY
COST ESTIMATE

for

SILVER SPRING STATION CAPACITY STUDY

Cost Estimates for Alternative E, Alternative **H** Option **D** and North Mezzaine Elevator Option

AECOM
3101 Wilson Blvd
Suite 900
Arlington, VA 22202
www.aecom.com

703.682.4900 tel
703.682.4901 fax

February 20, 2014

Bill Pugh
AECOM Transportation
2101 Wilson Blvd
Suite 800
Arlington, VA 22201

SILVER SPRING STATION CAPACITY STUDY - Cost Options, Silver Spring, MD

Dear Bill:

Please find enclosed our Construction Cost Estimate for the above referenced project based on Concept Design information.

	Const. Start	Gross Floor Area	$/sf	Estimated Cost
Alternative E	Jun-15			**$26,178,497**
Alternative H Option D	Jun-15			**$27,895,588**
North Mezzanine Elevator	Jun-15			**$9,149,494**

This estimate includes all direct construction costs, general contractor's overhead and profit contingency and soft costs. Cost escalation assumes start dates indicated above.

The estimate is based on union wage rates for construction in this market and represents a reasonable opinion of cost. It is not a prediction of the successful bid from a contractor as bids will vary due to fluctuating market conditions, errors and omissions, proprietary specifications, lack or surplus of bidders, perception of risk, etc. Consequently the estimate is expected to fall within the range of bids from a number of competitive contractors or subcontractors, however we do not warrant that bids or negotiated prices will not vary from the final construction cost estimate.

If you have any questions or require further analysis please do not hesitate to contact us.

Sincerely,

James Partridge
Associate

CONTENTS

	Page No.
Basis of Cost Estimate	1
Inclusions	2
Exclusions	3
Clarifications	4
Overall Summary	5
Alternative E	6
Alternative H Option D	10
North Mezzanine Elevator	14

BASIS OF COST ESTIMATE

Cost Estimate Prepared From	Dated	Received
Drawings issued for		
Concept Design Submission for North Mezzanine Elevator & Alternative E	10/11/13	10/15/13
Narrative Descriptions of Design Concepts		10/15/13
Narrative Descriptions of Design Concepts		10/31/13
Concept Design Submission for Alternative H Option D	01/30/14	01/30/14

Discussions with the Project Planners and Engineers

Discussions with WMATA.

Conditions of Construction

The pricing is based on the following general conditions of construction

- A start date of June 2015 (assume that coincides with start date of MTA Purple Line construction)
- A construction period of 60 months (assume that coincides with MTA Purple Line construction period)
- The general contract will be awarded to one construction manager and competitively bid to qualified subcontractors
- There will not be small business set aside requirements
- The contractor will be required to pay union wage rates
- Phasing for Alternative E and Alternative H Option D only
- The general contractor/construction manager will have full access to the site during normal business hours
- Compression of schedule, premium or shift work - construction along an active railroad (Metrorail and CSX operations), and restrictions on the contractor's working hours - An allowance for 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half is included with each line item (see detailed estimate)

INCLUSIONS

The proposed cost options for the Silver Spring Station Metrorail Station MD:-

Alternative E:

Includes the construction of the connection between the Purple Line Mezzanine floor and new access facility to the south end of the WMATA platform. The scope of work includes a connecting bridge (mezzanine level), installation of two elevators and three escalators to provide direct access to the WMATA rail platform at the lower level.

Alternative H Option D:

This is similar to the Alternative E . The general differences are that Alternate H has a wider bridge, longer mezzanine area, more faregates, and perpendicular rather than angled connection as compared to Alternate E.

North Mezzanine Elevator:

The installation of a new elevator to access the rail platform from the north mezzanine floor. It also includes increasing station capacity by rearranging station entry/exit facilities, a new break room and elevator machine room

The program also includes the provision of station entry/exit service facilities and the associated connections to the existing utilities.

Bidding Process - Market Conditions

This document is based on the measurement and pricing of quantities wherever information is provided and/or reasonable assumptions for other work not covered in the drawings or specifications, as stated within this document. Unit rates have been obtained from historical records and/or discussion with contractors. The unit rates reflect current bid costs in the area. All unit rates relevant to subcontractor work include the subcontractors overhead and profit unless otherwise stated. The mark-ups cover the costs of field overhead, home office overhead and profit and range from 10% to 20% of the cost for a particular item of work.

Pricing reflects probable construction costs obtainable in the project locality on the date of this statement of probable costs. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the construction work for all subcontractors and general contractors, with a minimum of 5 bidders for all items of work. Experience and research indicates that a fewer number of bidders may result in higher bids, conversely an increased number of bidders may result in more competitive bids.

Since AECOM has no control over the cost of labor, material, equipment, or over the contractor's method of determining prices, or over the competitive bidding or market conditions at the time of bid, the statement of probable construction cost is based on industry practice, professional experience and qualifications, and represents AECOM's best judgment as professional construction consultant familiar with the construction industry. However, AECOM cannot and does not guarantee that the proposals, bids, or the construction cost will not vary from opinions of probable cost prepared by them.

EXCLUSIONS

- Owner supplied and installed furniture, fixtures and equipment - (except as noted in the cost estimate)
- Loose furniture and equipment except as specifically identified
- Security equipment and devices - (except as noted in the cost estimate)
- Audio visual equipment
- Hazardous material handling, disposal and abatement
- Assessments, taxes, finance, legal and development charges
- Environmental impact mitigation
- Builder's risk, project wrap-up and other owner provided insurance program
- Land and easement acquisition
- Specialty Contractor parking requirements

CLARIFICATIONS and DEFINITIONS*

**It is anticipated that the project will be a Design & Build contract with a Construction Manager.*

Hard Construction

Design Contingency (item #18)

Design Contingency is an allowance for future design development, which alter the cost of the building as the design progresses, this percentage reduces as the design develops. It is based on a percentage of the sum of Sub-Total Construction, General Conditions and Requirements, Bond & Insurance and Building Permit.

Construction Management Fee (item #19)

Costs associated with general coordination of design reviews, meetings management, quality assurance, quality control, scheduling, financial close-out, and monitoring the project in the best interests of the client. Assume 7% allocation.

Escalation (item #20)

Escalation is included to allow for market/price fluctuations and is escalated to the mid-point of construction @ 3% per annum.

Soft Costs

Design and Engineering (item #21)

The costs associated with the design and engineering services to include drawings, specifications, change orders and other design documentation. (Including A&E bridge documents and CM completion of design). Assume 15% allocation.

Design Management (item #22)

Design support and oversight from WMATA and local county to include review of all drawings, specifications and construction documents as they are developed by A/E during Schematic Design, Design Development, and Construction Documents design phases of the project. as well as meetings, town hall meetings, scheduling and overall general cordination of A/E. Assume 15% alloaction.

Construction Support (item #23)

A general term for construction coordination and support by both WMATA and local county during construction to include; project management, site inspector(s), safety, scheduling, operation & maintenance manuals, contract administration, etc. Assume 20% allocation.

OVERALL SUMMARY COMPARISON - ORDER OF MAGNITUDE COSTS

Item	Description		Alternative E	Alternative H Option D	North Mezzanine Elevator
1	*DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW*		241,875	$241,875	$112,875
2	*EARTHWORK*		103,112	$103,112	$35,720
3	*UTILITY IMPACTS/REROUTING*		Included w/item 1	Included w/item 1	Included w/item 1
4	*ELEVATOR SHAFT*		531,782	$531,782	$473,424
5	*MEZZANINE FLOOR*		1,800,485	$2,118,504	$0
6	*STANDARD WMATA ELEVATORS*		900,000	$900,000	$450,000
7	*STANDARD WMATA ESCALATORS*		1,050,000	$1,050,000	not required
8	*INTERIOR BUILD-OUT*		2,559,844	$2,678,508	$1,452,648
9	*MECHANICAL*		510,625	$604,344	$510,625
10	*ELECTRICAL/COMMUNICATION*		1,075,806	$1,089,072	$410,650
11	*ELEVATOR DOWN TIME (costs of WMATA bus-bridge)*		not required	not required	not required
12	*EXTERIOR WORK*		616,486	$688,726	$0
13	*LABOR COSTS*		included above	included above	included above
14	*PHASING REQUIREMENT*		469,501	$500,296	N/A
SUB-TOTAL CONSTRUCTION			**$9,859,516**	**$10,506,219**	**$3,445,942**
Markups					
	General Conditions				
15	General conditions and project requirements	18.0%	$1,774,713	$1,891,119	$620,270
16	Bond and Insurance	3.0%	$349,027	$371,920	$121,986
17	Building Permit	1.5%	$179,749	$191,539	$62,823
PLANNED CONSTRUCTION COST			**$12,163,005**	**$12,960,797**	**$4,251,021**
Contingencies/Escalation					
	Contingencies				
18	Design Contingency	20.0%	$2,432,601	$2,592,159	$850,204
19	Construction Management Fee	7.0%	$1,021,692	$1,088,707	$357,086
	Escalation				
20	Escalation to mid-point construction (4Q2017)	11.75%	$1,835,033	$1,955,395	$641,352
ESTIMATED CONTRACT AWARD (Hard Costs)			**$17,452,331**	**$18,597,058**	**$6,099,663**
Soft Costs					
21	*Design + Engineering*	15.0%	$2,617,850	$2,789,559	$914,949
22	*Design Management*	15.0%	$2,617,850	$2,789,559	$914,949
23	*Construction Support**	20.0%	$3,490,466	$3,719,412	$1,219,933
ESTIMATED CONTRACT AWARD (Hard & Soft Costs)			**$26,178,497**	**$27,895,588**	**$9,149,494**
24	**ESCORT ALLOWANCE included with Construction Support*		included above	included above	included above
ESTIMATED CONTRACT AWARD (Hard, Soft and Escort Costs)			**$26,178,497**	**$27,895,588**	**$9,149,494**

	Quantity	*Unit*	*Rate*	*Total*
Alternative E				
1. DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW				
Necessary demolition, re-routing of cables, connect to existing Electrical/Mechanical systems, removal of pylon signs/lamppost with other lightings etc., complete	1	LS	150,000.00	150,000
Allow for cutting and removal of existing mezzanine walls to access connecting floor, slabs and at column locations @ platform	1	LS	75,000.00	75,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	16,875.00	16,875
				$241,875
2. EARTHWORK				
Shaft wall earthwork				
Excavation	71	CY	75.00	5,333
Backfill with gravel	33	CY	50.00	1,659
Remove excavated material off site	38	CY	100.00	3,793
Support of excavation - Shoring	512	SF	45.00	23,040
Column base earthwork				
Excavation	37	CY	75.00	2,775
Backfill with gravel	20	CY	50.00	983
Remove excavated material off site	17	CY	100.00	1,733
Support of excavation - Shoring	272	SF	45.00	12,240
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	51,556.00	51,556
				$103,112
3. UTILITY IMPACTS/REROUTING				
Utility impacts/rerouting			incl w/Demolition/Re-routing section	
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at	1	LS	0.00	
				$0
4. ELEVATOR SHAFT				
Shaft				
Excavation				incl above
Remove excavated material off site				incl above
Backfill with gravel				incl above

Alternative E

	Quantity	Unit	Rate	Total
Formwork to slab edge	96	SF	30.00	2,880
Reinforcement in slab	2,370	LB	2.00	4,741
Concrete in slab	9	CY	200.00	1,896
Formwork to pit walls	768	SF	30.00	23,040
Reinforcement	13,440	LB	2.00	26,880
Concrete in pit walls	14	CY	200.00	2,844
Cementitious waterproofing to elevator pit	384	SF	25.00	9,600
Miscellaneous concrete costs - premium for pump grade concrete mix and pump	24	CY	100.00	2,370
Glazed aluminum framed walls	1,920	SF	200.00	384,000
Concrete roof with water proofing	162	SF	55.00	8,910
Scaffolding	1,920	SF	6.00	11,520
CMU wall				
18" thick reinforced cmu wall @ dividing wall	320	SF	50.00	16,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	37,101.08	37,101
				$531,782

5. MEZZANINE FLOOR				
Column				
Excavation				incl above
Remove excavated material off site				incl above
Backfill with gravel				incl above
Formwork to pad edge	336	SF	30.00	10,080
Reinforcement in pad	4,333	LB	2.00	8,667
Concrete in pad	17	CY	200.00	3,467
Steel Column	27	TON	4,500.00	122,958
Fire proofing	27	TON	200.00	5,465
Mezzanine Floor Slab				
Steel beams and girders	68	TON	4,500.00	303,750
Precast unit slab	6,250	SF	50.00	312,500
Mezzanine Roof Slab				
Steel beams and girders	75	TON	4,500.00	337,500
Precast unit slab w/roofing treatment	6,375	SF	50.00	318,750
Allowance for hoisting including mobilization and demobilization	1	LS	250,000.00	250,000
Miscellaneous concrete costs - premium for pump grade concrete mix and pump	17	CY	100.00	1,733
Miscellaneous				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	125,615.25	125,615
				$1,800,485

	Quantity	*Unit*	*Rate*	*Total*
Alternative E				
6. STANDARD WMATA ELEVATORS				
Standard WMATA Elevators (mezzanine to platform), assume hydraulic elevator	2	EA	450,000.00	900,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$900,000
7. STANDARD WMATA ESCALATORS				
Standard WMATA Escalators (from platform to mezzanine floor) - WMATA to verify pricing	3	EA	350,000.00	1,050,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$1,050,000
8. INTERIOR BUILD-OUT				
Guardrails				assume not required
New station entrance gate	1	EA	55,000.00	55,000
Finishing - ceiling/floor	6,250	SF	45.00	281,250
Specialized equipment provided by WMATA				
Fare gate (6# standard & 1# ADA)	7	EA	45,000.00	315,000
Fare gate collection system	1	LS	1,300,000.00	1,300,000
Kiosk including structure, electrical and mechanical and installation	1	EA	350,000.00	350,000
Exit Stair				assume not required
Escalator stairs from platform to mezzanine	2	FLT	15,000.00	30,000
Allow for miscellaneous interior work	1	LS	50,000.00	50,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	178,593.75	178,594
				$2,559,844
9. MECHANICAL				
Plumbing and Drainage, allow	1	LS	100,000.00	$100,000
Fire Protection, allow	1	LS	125,000.00	$125,000
HVAC, allow	1	LS	250,000.00	$250,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	35,625.00	35,625
				$510,625
10. ELECTRICAL/COMMUNICATION				
Electrical, allow tie into existing system	1	LS	500,000.00	$500,000
Fare collections controls electrical	1	LS	32,000.00	$32,000
500KW emergency generator - allowance	1	LS	250,000.00	$250,000
Security, COMM, electrical specialties - tie into existing system, complete	6,250	SF	35.00	$218,750

	Quantity	*Unit*	*Rate*	*Total*
Alternative E				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	75,056.25	75,056
				$1,075,806
11. ELEVATOR DOWN TIME (costs of WMATA bus-bridge)				
WMATA bus bridge - allowance				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
12. EXTERIOR WORK				
Elevator enclosure at mezzanine				assume not required
12" reinforced CMU wall, allow	3,600	SF	50.00	180,000
Scaffolding	3,600	SF	6.00	21,600
Canopy - including lighting, complete	2,125	SF	175.00	371,875
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	43,010.63	43,011
				$616,486
13. LABOR COSTS				
Labor costs				included above
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
SUB TOTAL				**$9,390,015**
14. PHASING REQUIREMENT				
It is anticpated that phasing will be required to ensure that the station remain operational as much as possible. A 5% phasing allowance is included	1	LS	469,500.75	469,501
SUB TOTAL Including phasing requirement				**$9,859,516**

Alternative H Option D

	Quantity	Unit	Rate	Total
1. DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW				
Necessary demolition, re-routing of cables, connect to existing Electrical/Mechanical systems, removal of pylon signs/lamppost with other lightings etc., complete	1	LS	150,000.00	150,000
Allow for cutting and removal of existing mezzanine walls to access connecting floor, slabs and at column locations @ platform	1	LS	75,000.00	75,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	16,875.00	16,875
				$241,875
2. EARTHWORK				
Shaft wall earthwork				
Excavation	71	CY	75.00	5,333
Backfill with gravel	33	CY	50.00	1,659
Remove excavated material off site	38	CY	100.00	3,793
Support of excavation - Shoring	512	SF	45.00	23,040
Column base earthwork				
Excavation	37	CY	75.00	2,775
Backfill with gravel	20	CY	50.00	983
Remove excavated material off site	17	CY	100.00	1,733
Support of excavation - Shoring	272	SF	45.00	12,240
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	51,556.00	51,556
				$103,112
3. UTILITY IMPACTS/REROUTING				
Utility impacts/rerouting			incl w/Demolition/Re-routing section	
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at	1	LS	0.00	
				$0
4. ELEVATOR SHAFT				
Shaft				
Excavation				incl above
Remove excavated material off site				incl above
Backfill with gravel				incl above

	Quantity	Unit	Rate	Total
Alternative H Option D				
Formwork to slab edge	96	SF	30.00	2,880
Reinforcement in slab	2,370	LB	2.00	4,741
Concrete in slab	9	CY	200.00	1,896
Formwork to pit walls	768	SF	30.00	23,040
Reinforcement	13,440	LB	2.00	26,880
Concrete in pit walls	14	CY	200.00	2,844
Cementitious waterproofing to elevator pit	384	SF	25.00	9,600
Miscellaneous concrete costs - premium for pump grade concrete mix and pump	24	CY	100.00	2,370
Glazed aluminum framed walls	1,920	SF	200.00	384,000
Concrete roof with water proofing	162	SF	55.00	8,910
Scaffolding	1,920	SF	6.00	11,520
CMU wall				
18" thick reinforced cmu wall @ dividing wall	320	SF	50.00	16,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	37,101.08	37,101
				$531,782
5. MEZZANINE FLOOR				
Column				
Excavation				incl above
Remove excavated material off site				incl above
Backfill with gravel				incl above
Formwork to pad edge	336	SF	30.00	10,080
Reinforcement in pad	4,333	LB	2.00	8,667
Concrete in pad	17	CY	200.00	3,467
Steel Column	27	TON	4,500.00	122,958
Fire proofing	27	TON	200.00	5,465
Mezzanine Floor Slab				
Steel beams and girders	83	TON	4,500.00	374,366
Precast unit slab	7,703	SF	50.00	385,150
Mezzanine Roof Slab				
Steel beams and girders	92	TON	4,500.00	415,962
Precast unit slab w/roofing treatment	7,857	SF	50.00	392,853
Allowance for hoisting including mobilization and demobilization	1	LS	250,000.00	250,000
Miscellaneous concrete costs - premium for pump grade concrete mix and pump	17	CY	100.00	1,733
Miscellaneous				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	147,802.56	147,803
				$2,118,504

	Quantity	*Unit*	*Rate*	*Total*
Alternative H Option D				
6. STANDARD WMATA ELEVATORS				
Standard WMATA Elevators (mezzanine to platform), assume hydraulic elevator	2	EA	450,000.00	900,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$900,000
7. STANDARD WMATA ESCALATORS				
Standard WMATA Escalators (from platform to mezzanine floor) - WMATA to verify pricing	3	EA	350,000.00	1,050,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$1,050,000
8. INTERIOR BUILD-OUT				
Guardrails				assume not required
New station entrance gate	1	EA	55,000.00	55,000
Finishing - ceiling/floor	7,703	SF	45.00	346,635
Specialized equipment provided by WMATA				
Fare gate (7# standard & 1# ADA)	8	EA	45,000.00	360,000
Fare gate collection system	1	LS	1,300,000.00	1,300,000
Kiosk including structure, electrical and mechanical and installation	1	EA	350,000.00	350,000
Exit Stair				assume not required
Escalator stairs from platform to mezzanine	2	FLT	15,000.00	30,000
Allow for miscellaneous interior work	1	LS	50,000.00	50,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	186,872.63	186,873
				$2,678,508
9. MECHANICAL				
Plumbing and Drainage, allow	1	LS	100,000.00	$100,000
Fire Protection, allow	1	LS	154,060.00	$154,060
HVAC, allow	1	LS	308,120.00	$308,120
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	42,163.50	42,164
				$604,344

	Quantity	*Unit*	*Rate*	*Total*
Alternative H Option D				
10. ELECTRICAL/COMMUNICATION				
Electrical, allow tie into existing system	1	LS	500,000.00	$500,000
Fare collections controls electrical	1	LS	32,000.00	$32,000
500KW emergency generator - allowance	1	LS	250,000.00	$250,000
Security, COMM, electrical specialties - tie into existing system, complete	7,703	SF	30.00	$231,090
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	75,981.75	75,982
				$1,089,072
11. ELEVATOR DOWN TIME (costs of WMATA bus-bridge)				
WMATA bus bridge - allowance				not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
12. EXTERIOR WORK				
Elevator enclosure at mezzanine				assume not required
12" reinforced CMU wall, allow	4,800	SF	50.00	240,000
Scaffolding	4,800	SF	6.00	28,800
Canopy - including lighting, complete	2,125	SF	175.00	371,875
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	48,050.63	48,051
				$688,726
13. LABOR COSTS				
Labor costs				included above
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
SUB TOTAL				**$10,005,923**
14. PHASING REQUIREMENT				
It is anticpated that phasing will be required to ensure that the station remain operational as much as possible. A 5% phasing allowance is included	1	LS	500,296.14	500,296
SUB TOTAL Including phasing requirement				**$10,506,219**

North Mezzanine Elevator

	Quantity	Unit	Rate	Total
1. DEMOLITION/RE-ROUTING & RE-BUILDING - ALLOW				
Necessary demolition, re-routing of cables, connect to existing Electrical/Mechanical systems, removal of pylon signs/lamppost with other lightings etc., complete	1	LS	75,000.00	75,000
Allow for cutting and removal of existing concrete slab for elevator pit excavation on platform	1	LS	30,000.00	30,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	7,875.00	7,875
				$112,875
2. EARTHWORK				
Shaft wall earthwork				
Excavation	50	CY	75.00	3,756
Backfill with gravel	26	CY	50.00	1,304
Remove excavated material off site	24	CY	100.00	2,400
Support of excavation - Shoring	208	SF	50.00	10,400
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	17,860.00	17,860
				$35,720
3. UTILITY IMPACTS/REROUTING				
Utility impacts/rerouting			incl w/Demolition/Re-routing section	
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
4. ELEVATOR SHAFT				
Shaft				
Excavation				incl above
Remove excavated material off site				incl above
Backfill with gravel				incl above
Formwork to slab edges slab & roof	144	SF	30.00	4,320
Reinforcement in slab	1,500	LB	2.00	3,000
Concrete in slab	6	CY	200.00	1,200
Formwork to pit walls	3,105	SF	30.00	93,150
Formwork to shaft roof	81	SF	30.00	2,430
Reinforcement	4,233	LB	2.00	8,467
Concrete in pit walls	14	CY	200.00	2,733
Glazed alluminum frame enclosure	1,512	SF	200.00	302,400

	Quantity	*Unit*	*Rate*	*Total*
North Mezzanine Elevator				
Concrete roof with water proofing	81	SF	55.00	4,455
Cementitious waterproofing to elevator pit	288	SF	25.00	7,200
Miscellaneous concrete costs - premium for pump grade concrete mix and pump	20	CY	100.00	1,967
Scaffolding	1,512	SF	6.00	9,072
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	33,029.55	33,030
				$473,424
5. MEZZANINE FLOOR				
Elevator access to platform via existing South Mezzanine elevator will be maintained during the construction				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
6. STANDARD WMATA ELEVATORS				
Standard WMATA Elevators (mezzanine to platform), assume hydraulic elevator	1	EA	450,000.00	450,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$450,000
7. STANDARD WMATA ESCALATORS				
Operations and access of existing escalators will be maintained during construction				
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
8. INTERIOR BUILD-OUT				
Finishing - ceiling/floor, allow	3,000	SF	45.00	135,000
Specialized equipment provided by WMATA				
Fare gate	3	EA	45,000.00	135,000
Fare gate collection system (new exit fare machine), allow	1	LS	500,000.00	500,000
Carefully remove, store & reinstall existing exit fare machine, complete - allow	1	EA	200,000.00	200,000
Carefully remove, store & reinstall existing fare gate, complete - allow	5	EA	25,000.00	125,000

	Quantity	*Unit*	*Rate*	*Total*
North Mezzanine Elevator				
Carefully remove, store & reinstall existing kiosk, complete - allow	1	EA	195,000.00	195,000
kitchenette @ break room				
Base cabinet with countertop	10	LF	350.00	3,500
Wall cabinet	10	LF	170.00	1,700
Single leaf door including, hardware, framing etc, complete	3	EA	1,600.00	4,800
6" CMU - interior	1,425	SF	30.00	42,750
Scaffolding	1,425	SF	6.00	8,550
* Assume 60% of Estimated Contract Award is la	1	LS	101,347.50	101,348
				$1,452,648
9. MECHANICAL				
Plumbing and Drainage, allow	1	LS	100,000.00	$100,000
Fire Protection - adapt & amend, allow	1	LS	75,000.00	$75,000
HVAC - adapt & amend, allow	1	LS	300,000.00	$300,000
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	35,625.00	35,625
				$510,625
10. ELECTRICAL/COMMUNICATION				
Electrical, allow	1	LS	350,000.00	$350,000
Fare collection controls electrical, allowance	1	LS	32,000.00	$32,000
Security, COMM, Electrical specialties - tie into existing systems, complete				assume not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half	1	LS	28,650.00	28,650
				$410,650
11. ELEVATOR DOWN TIME (costs of WMATA bus-bridge)				
Elevator access to platform via existing South Mezzanine elevator will be maintained during the construction				assume not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
12. EXTERIOR WORK				
Elevator enclosure at mezzanine				assume not required
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above

	Quantity	*Unit*	*Rate*	*Total*
North Mezzanine Elevator				
				$0
13. LABOR COSTS				
Labor costs				included above
* Assume 60% of Estimated Contract Award is labor; 25% of labor is premium time & is paid at time and a half				included above
				$0
14. PHASING REQUIREMENT				assume not required
SUB-TOTAL				**$3,445,942**